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UNIT - 8: Hydrocarbons and Environmental Chemistry

## **HYDROCARBONS**

 Organic compounds composed of only carbon and both the front and back carbons are drawn using hydrogen are known as hydrocarbons. sticks at 120° angle. The left-hand bottom end of this locates atoms nearer to the observer and right-CLASSIFICATION

#### ALKANES

General representation: R-H

- General formula: CaH2x+2
- Hybridisation: sp Geometry : Tetrahedral

### Conformations

 Sawhorse projection: It is a view of molecule down a particular C - C bond, and groups connected to



Newman projection: In Newman projection, the two carbon atoms forming the σ-bond are represented by two circles, one behind the other, so that only front carbon is seen. The hydrogen atoms attached to the front carbon are shown by the bonds from the centre of the circle while the atoms attached to the back carbon are shown by the bonds from the circumference.

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E

N

### Methods of Preparation

Decarboxylation R - COONa NaOHICHO Kolbe's electrolytic method

2RCOOK ---- Ele

Reduction of alkyl halide R = X + 2[H] Za/HCl  $R = X + H_2 \xrightarrow{Pd} K$ 

Wurtz reaction R = X + 2Na + X = R Dryether Corey-House reaction

R2CuLi + R'X Dry other RMgX + H2O H+ From Grignard reagent

 $RX + Zn + XR \xrightarrow{\text{ether}} N$ Frankland's method Reduction method RCH-OH/RCHO/RCOR/RCOOH HURad P

RCHO/RCOR - Zn-Hg/HC1 (Clemmensen reduction RCHO/RCOR -(Welf-Kishner reduction)

## Chemical Properties

A  $X_2 \rightarrow R - X + HX$ HO-NO<sub>2</sub> > R-NO<sub>2</sub> + H<sub>2</sub>O

110-50yH 50<sub>3</sub> 675 K = SO<sub>3</sub>H + H<sub>2</sub>O  $KMnO_4 \rightarrow R - OH$  $O_2, \Delta \rightarrow R - COOH$ 

A Cu/523 K > R - OH Anhyd AICI, Isomers of respective alkanes

(Isomerisation) >C6H12+H2 C<sub>6</sub>H<sub>14</sub> 773 K → C<sub>4</sub>H<sub>8</sub> + C<sub>2</sub>H<sub>6</sub>

(Pyrolysis) CoHe+CoHe+CHe Propens Ethene Methane

### ALKENES

- General representation: RR-C=CR-R-
- General formula: C,H<sub>2</sub>
- Hybridisation: sp2
  - Geometry: Planar triangular

Methods of Preparation Dehydration of alcohols

R-Br + KOE

CH2COONa Electrolysis CH-COONs

#### **Chemical Properties**

H<sub>2</sub>Ni,PtorN S23-573 K R—CH<sub>3</sub>  $Br_2/CCI_4 \rightarrow RCHBrCH_2Br$ 

→ R - CH - CH<sub>3</sub> (Markovníkov's rule) (X=Be) R - CH<sub>2</sub>- CH<sub>3</sub>Be (Anti-Markovníková role)

 $H_2O/H_2SO_4 \rightarrow R - CH(OH) - CH_3$ B<sub>2</sub>H<sub>4</sub>/H<sub>2</sub>O<sub>3(dR)</sub> → RCH<sub>2</sub>CH<sub>2</sub>OH

(Hydroboration - oxidation) OlyHg/THF R-CH-CHo OH (Oxymercuration-demercuration) (Oxidation) RCH-CH2 OH OH

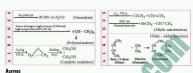


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(Oxidation)



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- General representation: R<sub>1</sub>C=CR<sub>2</sub> General formula: C<sub>n</sub>H<sub>2n-2</sub>
- Hybridisation : st
- · Geometry: Linear

### Methods of Preparation

Dehydrohalogenation of dihalides CH<sub>2</sub>Br - CH<sub>2</sub>Br alc KON, A or NaNIL, in NIL By heating tetrahalides with Zn dust CHCl<sub>2</sub> - CHCl<sub>2</sub> + 2Zn -

CHCOO. CHCOO. CaC+2H4O Calcium cerbide erthelot synthesis Electric arc, 3270 K 2C + H<sub>o</sub>

4(05, KOMsO<sub>p</sub> → (COOCH)<sub>2</sub> |O| → 2CO<sub>2</sub> + H<sub>2</sub>O

 $O_0(CH_0C)_{\Sigma}$   $\rightarrow$   $(CHO)_2$ 

By heating iodoform with silv CHL+6Ag+CHL

Chemical Properties



E

CHC1<sub>2,C1</sub>CCL, CHC1 (CI-CH-CH-OH) d OH HO (CI)2CH - CHO

CHCI, CHC

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, a,ca,

#### AROMATIC HYDROCARBONS

- Aromatic hydrocarbons are also called arenes. Renzene is the simplest aromatic hydrocarbon.
- Arenes can be described by the general formula C.H ... where n is the number of carbon atoms and m is the number of benzene rings.

e.g. for monocyclic arenes. m = 1 and n = 6, or more. For bicyclic arenes.



#### Methods of Prepartion

- Cyclic polymerisation of ethyne :
  - 3CH = CH red hot Fe-tabe
  - Decarboxylation of aromatic acids: COONs + NaOH CaO. 6
- Reduction of phenol:

## **Chemical Properties**



**Hückel Rule of Aromaticity** 

- he following criteria:
- A compound is said to be arematic, if it meets all of
- ounds contain one or more rings that have a cyclic arrangement of p-orbitals.
- Anti-aromatic Aromatic · Cyclic, planar melecule Cyclic, planar molecule · Complete delocalisation of Complete delocalisation of z-electrons
- π-electrons Follows Huckel's rule (4n + 2) x e s
   Follows 4n x e s

- (Friedel-Crafts
- Aromatic rings are planar.
- Aromatic systems are conjugated cyclic systems. Aromatic systems must contain (4n + 2) π-electrons used in delocalisation, where n = integer (0, 1, 2, ...)
  - Non-aromatic Either non-cyclic, non-planar
  - No delocalisation of z-electrons May or may not follow

 $(4n + 2) \pi e$ 's rule.  cation, benzene, etc.

 e.g., cycloheptatrienyl cation
 e.g., cyclopropenyl anion, (tropylium ion), cyclopropenyl cyclopentadienyl cation, etc. e.g., cyclooctatetraene (tub-shaped), etc.

> Atmosphere is a cover of gases upto the height

(Anti-grematic)

12, O2, CO2, H2O vapour N2, O2, O3, O-atoms N. O. O. NO 0\*, 0\*, NO\*, 4"

non-biodegradable

## ENVIRONMENTAL CHEMISTRY

- · Environmental chemistry deals with the study of the origin, transport, reactions, effects and fates of chemical species in the environment.
- · Environment means surroundings and it has four major components : atmosphere, hydrosphere,
- of 1600 km from the surface of earth. It is further divided into four regions: Altitude from Region Gases/Species present

lithosphere, biosphere,

Troposphere	0 - 11 km	Decreases from 15 to -56%
Stratosphere (Ozonosphere)	11 - 50 km	Increases from -56 to -2°C
Mesosphere	50 - 85 km	Decreases from -2 to -92%
Thermosphere	85 - 500 km	Increases from -92 to 1200

- Hydrosphere is that part which contains water in the form of oceans, rivers, lakes etc an pollutants: Biodegradable pollutants are those which covers 75% of earth's surface. Lithosphere consists of solid components like
  - soil, recks, mountains etc. > Biosphere is the part where living are interact with lithosphere.

atmosphere.

TYPES OF POLLUTANTS

- are easily decomposed by microorganisms either naturally or by suitable treatment e.g., discarded vegetables and non-biodegradable pollutants are those which do not decompose or decompose very slowly and are harmful to living organisms e.g., DDT.

#### Types of Pollution

#### · Primary and secondary pollutants : Primary Air Pollution

pollutants are those which remain as such in the environment after their formation like NO, SO2 NO2 whereas secondary pollutants are formed from the primary pollutants like PAN (Peroxyacetyl nitrates).

 It is the addition of undesirable materials into the atmosphere either due to natural phenomena or due to human activity on the earth which adversely affect the quality of the air and hence, affects the life on the earth.

plastic materials, heavy metals, etc.

Pollutants	Major sources	Effects
20	in automobile engines and defective furnaces,	Carbon monoxide is toxic. It binds with haemoglobin in red blood cells and prevents them from combining with oxygen. Low levels of O <sub>2</sub> cause headache and dizziness.
NO <sub>x</sub>	Combustion of fuel, natural forest fires, stationary combustion sources (factories and power plants), transportation.	Toxic to living tissues, harmful to plants and textiles.



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SO <sub>x</sub>	They are respiratory tract irritants, low concentration causes throat, eye irritation and breathlessness, affect larynx.
Hydrocarbens	At concentration greater than 500-1000 ppm, they have carcinogenic effect in lungs. They react with O <sub>2</sub> and NO <sub>3</sub> to form photochemical smog which have a strong damaging effect on human being as well as plants.
CFCs	React with stratospheric ozone. When CFCs are broken down, chlorine free radicals are produced that depletes the ozone layer.
Particulates	Inhalation of metallic particles leads to respiratory disorders like asthma, bronchitis, lung cancer, etc.

#### The trapping of IR radiations by gases such as carbon

- diexide, methane, ozone, chlorofluorocarben compounds (CFCs) and water vapours in the atmosphere leading to the heating up of earths atmosphere is called greenhouse effect.

  The increase in concentration of greenbouse pases
- will lead to increase in average global temperature which is called global warming.

  Acid Rain

### When the pH of rain water falls below 5.6 due to

- presence of H<sub>2</sub>SO<sub>4</sub> and HNO<sub>3</sub>, furmed from the oxides of sulphur and nitrogen present in the air, it is called acid rain.

  Acid rain is harmful for agriculture, trees and plants as it dissolves and washes away not rients required
- for their grawth.

  It affects the aquatic ecosystem and damages buildings and other structures made of stone or

#### metal. Smoq

og is derived from smoke and fog. It is

Smeke +	Fog	$\rightarrow$	Smeg
(june	staning harmful	gan]	
Classical sn	aog	Photoch	temical smog
Also called a	AS	Also cal	led as Los
London smo	og.	Angeles	smog.

Formed due to
vides of sulptur.
Contains perimary
Contains secondary
poblement
Causes bronchitis and
Causes irritation in eyes.
problems in lungs.

- It is reducing in nature. It is oxidising in nature.

  Stratospheric pollution (Ozone depletion)

  Game (O<sub>2</sub>) present in the stratosphere prevents
  - about 99.5% of UV radiations from reaching the earth's surface and thereby protecting humans and other animals from its harmful effects. A dynamic equilibrium exists between the
  - production and decomposition of ozone molecules.  $C_{2(g)} \xrightarrow{UV} O_{(g)} + O_{(g)}$
  - $O_{(g)} + O_{2(g)} \xrightarrow{UV} O_{N(g)}$
  - The main reason of ozone layer depletion is the release of chlorofluorocarbon compounds (CFCs), also known as freons.

#### Water Pollution

 Water pollution may be defined as any change in its physical, chemical or biological properties or contamination with foreign materials that can adversely affect human beings or reduce its utility for the intended use.

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Major water pollutants and their sources:		
Pollutants	Major sources	
Natural wastes	Leaching of minerals, silt from so erosion, falling of organic matte from banks, etc.	
Organic	Pesticides, surfactants, detergent	

chemicals industrial wastes Metals (Hg. As. Nuclear power plants, mining, Pb, Cd, etc.) metal plating industries. Man-made Sewage, domestic waste, soaps wastes and detergents, waste from animal sheds and slaughter houses, run off

wastes, oil pollution. Effects of water pollution High concentrations of fluoride are poisonous and are harmful to bones and teeth at levels

over 10 ppm Excess nitrate in drinking water can lead to blue

from agricultural fields, industrial

- baby syndrome.
- Excess sulphate (> 500 ppm) have a laxative

- Biochemical Oxygen Demand (BOD): Milligrams of O2 consumed by microorganism
- Volume of sample (in L) Chemical Oxygen Demand (COD): Chemical
- exveen demand refers to the amount of exveen. expressed in parts per million, consumed under specific conditions in the oxidation of the organic and oxidizable morpanic matter contained in industrial waste water.

#### Soil Pollution

· The addition of substances in an indefinite proportion changing the productivity of the soil is known as soil pollution.

Sources of soil pollution > Agricultural pollutants or Agro Chemistry

- chemicals like pesticides, fertilisers, fumigants, insecticides, herbicides, fungicides. Domestic and industrial wastes. Radioactive wastes from research centres and
  - Soil conditioners containing toxic metals like Hg. Fb, As, Cd etc.
- Pollutants present in air from chemical works.

## SPEE

The compound (C) is

2. Which one of the following substances is not





# PRACTICE

3. Which exide of nitropen is not a common pollutant

introduced into the atmosphere both due to natural and human activity? (a) N<sub>2</sub>O<sub>6</sub> (b) NO2

(c) N<sub>2</sub>O (d) NO (NEET 2018) 4. The major product 'P' in the following reaction is  $CH_1CH_2C = CH \xrightarrow{BD_2} CH_1COOH \rightarrow P$ 

(a) Et C=CH (b) Et C=CH

- 5. Most dangerous metal pollutant of automobile exhausts is (b) copper
- (c) mercury (d) cadmium.
- 6. The reaction(s) leading to the formation of 1,3,5-trimethylbenzene is (are)

  - (b) Mc H heated iron tube
  - 1] Br<sub>p</sub>, NaOH 2) H,O\* 91 spdalime, 5
  - CHO (d)
- (IEE Advanced 2018) 7. Which one of the following statements is not true?
  - (a) Oxides of sulphur, nitrogen and carbon are the most widespread air pollutants.
  - (b) pH of drinking water should be between 5.5 and 9.5.
  - (c) Concentration of DO below 9 poor is good for the growth of fish. (d) Clean water would have a BOD value of
- than 5 ppm.
- (b) D -
  - (c) CI-
  - (d) D ton (A) reacts with bromine by substitution to form an alkyl bromide which by Wurtz reaction is converted to easeous hydrocarbon containing less than four carbon atoms. (A) is
  - (a) CH = CH (b) CH2 = CH2 (c) CH1 - CH1 (d) CH4 (NEET 2018)
  - 10. Addition of HBr to 1-butene gives a mixture of products A, B and C.

CH,CH,CH,CH,

The mixture consists of (a) A and B as major and C as minor pro

- (b) B as major, A and C as minor product (c) B as minor, A and C as major product
- (d) A and B as minor and C as major product. 11. Select the correct statement (a) CFCs are transporting agents for continuously
- generating Cl' into stratosphere and damaging ezone layer. (b) The upper stratosphere consists of considerable amount of C.
- c) Ozone in the stratosphere is a product of UV radiations acting on O2 molecules. All are correct statements.
- The major product formed in the following reaction
- NO,
- NO.
  - Solution Senders of Chemistry Musing
  - Set 65 Deepti Bhatnagar, Madhya Pradesh
  - Set 66 Ajay Kaushik, Uttar Pradesh S. Srinivas, Telangana

(JEE Main Online 2018)

- The products (1) and (II) are respectively (a) trans-CH-CH=CHBr, CH-CH-CHBr-
- (b) CH,CBr = CH, CH,CHBrCH,Br
- (c) cis-CH<sub>3</sub>CH=CHBr, CH<sub>3</sub>CHBrCH<sub>3</sub>Br (d) trans-CH-CH = CHBr, CH-CHBrCH-Br
- 14. Which one among the following carbocations has

15. The living organisms or the materials which are adversely affected by the pollutants are called (a) sink (b) receptors

(c) targets (d) both (b) and (c). 16. In which of the following molecules, all atoms are ceplanar?

17. When rain is accompanied by a thunderstorm, the

- collected rain water will have a pH value (a) which depends upon the amount of dust in air (b) slightly lower than that when rain water is
- without thunderstorn (c) slightly higher than that when the thunderstorm
- (d) uninfluenced by occurrence of thunderstorm.
- 18. Which of the following practices will not come der green chemistry? (a) If possible making use of soap made of vegetable
  - oils instead of using synthetic detergents.
  - (b) Using plastic cans for storage purpose.
  - (c) Using bicycle for travelling small distances. instead of using petrol/diesel based vehicles. (d) Using H<sub>2</sub>O<sub>2</sub> for bleaching purposes instead of
- using chlorine-based bleaching agents.

- 19. A fertile soil is likely to have a pH of (a) 3 (h) 9 (c) 6.7 (d) 14
- 20. Basic strength of
- (i) H4CCH7 (ii) H4C=CH7 (iii) H-C=C7
  - is in the order (a) (iii) > (ii) > (ii)
  - (b) (i) > (iii) > (ii) (c) (i) > (ii) > (iii) (d) (ii) > (0 > Gii)
- 21. Consider the addition of HBr to 1, 3-butadie I. Markownikoff addition of
  - allylic carbocation. ÆH.
- (X) is the kinetic
- cis-1-bromo-2-butene from (Y) is the thermodynamic product. Select the correct statements
- (a) Only I and II (b) Only II and III (c) Only I and III (d) 1, II and III A water sample has ppm level concentration of following aniens, F = 10; SO<sub>4</sub> = 100; NO<sub>5</sub> = 50.
- The anion/anions that makes/make the water sample unsuitable for drinking is/are (a) only F
- (b) only SO2
- (c) only NO
- (d) both SO4 and NO3. (IEE Main 2017) 23. In winter season, special type of clouds called
  - Polar Stratospheric Clouds (PSC) are formed over Antarctica. As a result, less depletion of ozone laver takes place due to reactions
  - (a) CIONO2 + H2O --- HOCI + HNO3
  - (b) CIONO, + HCI --- CI, + HNO,
  - (c) both (a) and (b) (d) none of the shove
- 24. Product X in the following reaction is H,CO,H, CHCl,
  - OH

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- 25. The region which is greatly affected by air pollution is
  - (a) troposphere
  - (b) stratosphere
  - (c) mesosphere

## (d) thermosphere.

9. (d)

 (a): Markovition's addition of HBr to 1-butene gives (I) as the major and (C) as the minor product. CH<sub>2</sub>CH<sub>2</sub>CH = CH<sub>2</sub> HBr

CH<sub>3</sub>CH<sub>2</sub>—CHBr—CH<sub>3</sub> + CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>=Br

Since (I) contains a chiral carbon, it exists in two enantiomers (A) and (B) which are mirror images of each other. Thus, the mixture contains A and B as major and C as a minor product.

11. (d) 12. (d)

HBs/ROOR Anti-Mark addn. CH<sub>3</sub>—CHBr—CH<sub>2</sub>Br

- (II) 15. (d) 16. (a)
- 14. (a) 15. (d) 16. (a) 17. (b): Normal rain water has a pH value 5.6. I
- to the action of thunderstorm, water undergoes ionisation producing hydronium ions, as a result, pH lowers slightly. Therefore, ratn water accompanying thunderstorm has a pH lower than 5.6.
  - 18. (b) 19. (c)
    20. (c): Acid character increases in the order:
  - (c): Acid character increases in the order: CH<sub>3</sub>CH<sub>3</sub> < CH<sub>2</sub> − CH<sub>2</sub> < HC≡CH therefore, basic strength decreases in the reverse
    - therefore, basic strength decreases in the reverse order, i.e., CH<sub>2</sub>CH<sub>2</sub>(i)>H<sub>2</sub>C=CH<sup>\*</sup>(ii)>HC=C<sup>\*</sup>(iii)

Stability of (Y) (more substituted) is higher than that of (X) thus, (Y) is under thermodynamic control and (X) is under kinetic control.

EXAM ALERT 2019

JEE Main II	6th to 20th April
WTEEE	10 <sup>th</sup> to 21 <sup>th</sup> April
SRMIEEE	15 <sup>th</sup> to 25 <sup>th</sup> April
J&K CET	21 <sup>st</sup> April
KEAM	22 <sup>rd</sup> & 23 <sup>rd</sup> April
Kamataka CET	23 <sup>rd</sup> & 24 <sup>th</sup> April
AMU (Engg.)	28 <sup>th</sup> April
NEET	5 <sup>th</sup> May
COMEDK (Engg.)	12 <sup>th</sup> May
BTSAT	16 <sup>th</sup> to 26 <sup>th</sup> May
JEE Advanced	19 <sup>th</sup> May
AIMS	25 <sup>th</sup> & 26 <sup>th</sup> May
WB JEE	26 <sup>th</sup> May

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Class XI



storming MCQs ige in your NEET prepa

1. The acid strength order of the following compounds is:

(a) 1 > IV > II > III (b) III > 1 > II > IV (c) II > III > I > IV (d) 1 > III > II > IV 2. 40 mL of 0.05 M solution of sodium sesquicarbonate (Na<sub>2</sub>CO<sub>2</sub>NaHCO<sub>2</sub>2H<sub>2</sub>G) is titrated against 0.05 M HCl. When phenolphthalein is used as indicator,

x mL HCl is used. In a separate titration of same solution using methyl orange as indicator, y ml. of HCl is used. The value of (y - x) is (a) 80 mL (b) 30 mL (c) 120 mL (d) 180 ml.

A metal (M) burns with dazzling brilliance in air to give a white powder. The product reacts with water to form a white precipitate and a colourless gas with a characteristic smell. The metal (M) decomposes hot water but not cold water, liberating the inflammable hydrogen gas. The metal (M) is (b) Ca (c) Me (d) Rh

 100 cm<sup>3</sup> of a given sample of H<sub>2</sub>O<sub>2</sub> gives 1000 cm<sup>3</sup> of O2 at STP. The given sample is

(a) 10 volume H-O-(b) 90% H<sub>2</sub>O<sub>2</sub> (c) 10% H<sub>2</sub>O<sub>2</sub> (d) 100 volume H-O-Identify the major product (P) in the following segmence of reactions. C<sub>2</sub>H<sub>30</sub> Br<sub>2</sub>fer C<sub>2</sub>H<sub>0</sub>Br

(Only one isomer) Ether

A gas mixture contains equal number of molecules

of N2 and SF4, some of it is passed through a gasecus effusion apparatus. How many molecules of N<sub>2</sub> are present in the gaseous product for every 100 molecules of SF.? (a) 228 (b) 216 (c) 220 (d) 218

The correct order of the increasing s-character of the orbital of B which overlaps with the orbital of F to form B-F bond in BF's BF, and BF7 is (a) BF; < BF; < BF.

(b) BF, < BF; < BF; (c) BF2 < BF3 < BF4 (d) BF; < BF, < BF

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 The total work done by a gas (in Joule) if system follows an expansion process as shown in figure is



(a) 2000 J (b) 500 J (c) 1000 J (d) 1500 J

(a) 1

 One mole of N<sub>2</sub>H<sub>4</sub> loses 10 mole of electrons to form a new compound Y. Assuming that all nitrogen appear in the new compound, what is the oxidation

state of nitrogen in Y? (There is no change in the oxidation state of hydrogen.)

(a) +3 (b) -3 (c) -1 (d) +5

10. In a reaction at equilibrium 'x' moles of the reactant A decomposes to give 1 mole each of C and D. If the fraction of A decomposed at equilibrium is independent of initial concentration of A, then the value of 'x' is

Which among the following statements are correct
 Energy needed for homolytic bend fission is

less than that required for the heterolytic bond fission.

II. Hemolytic bond fission gives neutral species

which is paramagnetic in character.

III. Energy needed for heterolytic bond fission is less than that required for the homolytic bond

fission.

IV. Heterolytic bond fission takes place in non polar

solvents.
(a) I only
(b) I and III only

(c) I and II only

(d) I, II and IV only

12. The electronegytivity difference between N and F
is greater than N and H, yet the dipole moment of
NH<sub>1</sub>(1.5 D) is greater than that of NF<sub>2</sub>(0.2D). This

 is because
 (a) in NH<sub>3</sub> as well as NF<sub>3</sub>, the atomic dipole and bend dipole are in opposite direction

bend dipole are in opposite direction (b) in NH<sub>3</sub>, the atomic dipole and bond dipole are in the opposite direction, whereas in NF<sub>3</sub> these

are in same direction (c) in NH<sub>3</sub> as well as in NF<sub>3</sub> the atomic dipole and bond dipole are in same direction. (d) in NH<sub>3</sub>, the atomic dipole and bond dipole are in same direction whereas in NF<sub>3</sub> these are in opposite direction.

 In cold water, DO (Dissolved Oxygen) can reach a concentration upto X ppm whereas exygen in air is about Y ppm. X and Y are

(a) 10 20 (b) 10 2.0 × 10<sup>5</sup> (c) 10 2.0 × 10<sup>4</sup>

(c) 10 2.0 × 10 (d) 20 10 14. Bond distance C—F in CF<sub>4</sub> and Si—F in SiF<sub>4</sub> are respectively 1.33 Å and 1.54 Å. C.—Si bond distance

respectively 1.33 Å and 1.54 Å, C – Si bond distance is 1.87 Å. The covalent radius of F atom (ignoring the electrone-pativity differences) is (a) 0.64 Å. (b) 1.33+1.54+1.87 Å

(a) 0.64 A (b) 3 (c) 0.5 Å (d) 1.54 Å

(c) 0.5 Å (d)  $\frac{1.54}{2} \text{ Å}$ The average life of an excited state of hydrogen atom

is of the order  $10^{-8}$ s. The number of revolutions made by an electron when it is in state n = 2 and before it suffers a transition to state n = 1 are (a)  $8.23 \times 10^6$  (b)  $2.82 \times 10^6$  (c)  $22.8 \times 10^6$  (d)  $2.28 \times 10^6$ 

stem is aromatic in nature. So, to gain aromaticity H

are easily released.

2. (a): 40 c.c. 0.05 M Na<sub>2</sub>CO<sub>3</sub> = 2 c.c. M Na<sub>2</sub>CO<sub>3</sub>

2. (a): 40 C.C. 0.05 M Na<sub>2</sub>CO<sub>3</sub> = 2 C.C. M Na<sub>2</sub>CO<sub>3</sub> 40 C.C. 0.05 M NaHCO<sub>3</sub> = 2 C.C. M NaHCO<sub>3</sub> When methyl orange is used as an indicator, the volume of HCl used corresponds to total alkali. i.e.

 $Na_2CO_3 + 2HCI \longrightarrow 2NaCI + H_2O + CO_2$   $NaHCO_3 + HCI \longrightarrow NaCI + H_2O + CO_2$   $\therefore 2 c.c. M Na_2CO_3 = 4 c.c. M HCI$ and  $2 c.c. M NaHCO_3 = 2 c.c. M HCI$ 

∴ y = 6 c.c. M HCl When phenelphthalein is used as an indicator the value of HCl used corresponds to half-neutralization of Na<sub>2</sub>CO<sub>2</sub>, i.e.,

NayCO3 + HCl --- NaHCO3 + NaCl

: 2 c.c. M Na<sub>2</sub>CO<sub>3</sub> = 2 c.c. M HCl

: x = 2 c.c. M HCl

: y - x = 6 - 2 = 4 c.c. M HCl = 80 c.c. 0.05 M HCl

3. (c): Mg reacts with air to form MgO and Mg, N,

 $2Mg + O_2 \longrightarrow 2MgO; 3Mg + N_2 \longrightarrow Mg_3N_{2i}$  $Mg_3N_3 + 6H_3O \longrightarrow 3Mg(OH)_3 + 2NH_3$ 

Hydrogen is liberated when Mg reacts with het water Rb, K and Ca gives hydrogen gas even with cold water.  $Mg + 2H_2O(hot) \longrightarrow Mg(OH)_2 + H_2$ 

(a): 2H<sub>2</sub>O<sub>2</sub> → 2H<sub>2</sub>O + O<sub>2</sub>

or 1 mL of H,O, will give 10 mL of O, at STP. Thus, its volume strength is 10 volume.

5. (b): 
$$\bigcirc$$
 Br<sub>3</sub>dw  $\bigcirc$  Br<sub>Esher</sub>  $\bigcirc$  MgBr<sub>Esher</sub>  $\bigcirc$  OH

6. (a): 
$$\frac{r_{\text{N}_2}}{r_{\text{SE}_6}} = \sqrt{\frac{146}{28}} = 2.28$$

For 100 molecules of SF. ⇒ 2.28 × 100 = 228 molecules of N s res

7. (d): Hybridisation % of s character 25

.. The order of increasing a  $BF_{4}^{*}(sp^{3}) < BE_{4}(sp^{2}) < BF_{5}^{*}(sp^{2})$ 

8. (a)  $: P_B V_B^2 = P_C V_C^2$ or  $50 \times (0.4)^2 = P_0 \times (0.8)^2$ 

0.8×0.8 w = wan + war

 $=-50(0.4-0.2)+P_CV_C-P_BV_B$ 

= -10 + (-10) = -20 bar litre = -2000 I w = 2000 I

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9. (a): N<sub>2</sub>H<sub>4</sub> → Y + 10e Oxidation state of N in N,H<sub>4</sub> =  $2x + 4 = 0 \implies x = -2$ As 1 mole of N2H4 loses 10 moles of electrons,

so 1 mole of N loses 5 moles of electrons Hence, exidation state of nitrogen = -2 + 5 = 3

10. (c) : xA = C + D

Initial

At eqm. a(1 - o)

If or is independent of a, then

: x=2

13. (b) : DC (Dissolved Oxygen) can reach a encentration upto 10 ppm in celd water while oxygen n air is about 2.0 × 105 ppm.

14. (c):  $r_c + r_c = 1.33 \text{ Å}$  $r_0 + r_0 = 1.54 \text{ Å}$ 

 $r_C + r_G + 2r_C = 2.87 \text{ Å}$  $r_C + r_S = 1.87 \text{ Å}$ 

 $2r_F = 2.87 \text{ Å} - 1.87 \text{ Å} \implies 2r_F = 1.00 \text{ Å}$ 15. (a): Velocity of electron, in nth orbit

 $v_{a} = 2.19 \times 10^{6} \times \frac{Z}{ms^{-1}}$ The velocity of electron in second Bohr's orbit.

 $y_2 = \frac{2.19 \times 10^6 \times 1}{m} s^{-1}$ 

The circumference of second orbit =  $2\pi r_0$  $= 2\pi \times 0.529 \times 10^{-10} \times 2^{2} = 13.3 \times 10^{-10} \text{ m}$ 

: Number of revolutions in 1 sec =  $\frac{v_2}{2\pi r_1}$ 

 $\frac{2 \times 13.3 \times 10^{-10}}{2 \times 13.3 \times 10^{-10}} = 8.23 \times 10^{14}$ 

Therefore number of revolutions made in 10<sup>-8</sup> sec = 8.23 × 10<sup>14</sup> × 10<sup>-8</sup> = 8.23 × 10<sup>6</sup>



queries and doubts related to this topic at editoritimits in. The queries will be entertained by the author

#### MOLECULAR ORBITAL THEORY

Valence bond theory fails to explain the paramagnetic nature of O<sub>2</sub> and S<sub>2</sub> molecules, higher bond dissociation energy of CO\* than CO molecules etc. It fails to explain the stability of odd electron species like H2, NO, etc. A new idea was put forward by Hund and Mulliken in 1932 and was further improved by Lenard and Jones

#### and is known as Molecular Orbital Theory (MOT). Main features of MOT All electrons of an atom take part in bonding

- Atomic orbitals lose their identity. Two atomic orbitals produce two molecular orbital Linear combination gives bonding sarma molecular
  - orbitals and antibonding sigma molecular orbitals while sideways combination gives bondin pi melecular orbitals and antibonding pi molec orbitals by linear combination of atomic orbitals.
  - O Bonding molecular orbitals have lower energy than combining atomic orbitals, higher electron density between the nuclei to stabilise the bond
  - Antibonding molecular orbitals have higher energy than combining atomic orbitals, lower electron density between the nuclei to destabilise the bond.
  - O Sequence of increasing energies for filling of molecular orbitals by electrons are: (a) upto 15 electrons, set-1 (mixing of 2s and 2p is
    - operative), GIs, G\* Is, G2s, G\*2s, R2p, = R2p, G2p,  $\pi^*2p_x = \pi^*2p_y, \sigma^*2p_z$
    - (b) For other cases, set-II (mixing of 2s and 2p is not operative), σ1ε, σ\*1ε, σ2ε, σ\*2ε, σ2ρ, π2ρ, = π2ρ, π\*2ρ, =
    - x\*20., 0\*20. (c) For CO. CO\* and CO\*, set-III.
    - π2ρ, = π2ρ, σ2ρ, σ2ρ, σ\*2s σ1ε σ\*1ε σ2ε.  $\pi^*2p_* = \pi^*2p_*, \sigma^*2p_*$ shifting

- Conditions for formation of mo Atomic orbitals must have comparable energies. Overlapping should be maximum.
  - Atomic orbitals must have same axial symmetry. Probability of finding electron in molecular orbital Addition overlap of atomic orbitals produces
- onding molecular orbitals where probability of nding electron (wasses) is higher by 2wa wa than n atomic orbitals (w + w n).
  - $\Psi_{RMO} = \Psi_A + \Psi_B$  $\psi^2_{BMO} = (\psi_A^2 + \psi_B^2) + (2\psi_A\psi_B)$ Subtraction overlap of atomic orbitals produces antibonding molecular orbitals where probability
  - of finding electron ( $\psi^2_{ABMO}$ ) is lower by  $2\psi_A \psi_B$ than in atomic orbitals  $(\psi_a^2 + \psi_a^2)$ .  $\Psi_{ABMO} = \Psi_A - \Psi_B$

 $\psi^2_{ABMO} = (\psi_A^2 + \psi_B^2) - (2\psi_A\psi_B)$ hapes of molecular orbital σls and σ2s (\*+\*) No nodal plane

o"ls and o"2s (+ One nodal

+ No nodal plane

One nodal plane Nodal plane

By R.C. Grover, having 45+ years of experience in teaching chemistry. 

#### BOND ORDER (B.O.)

It represents number of covalent bonds between bonded atoms. Mathematically, B.O. =  ${}^{1}[N_b - N_a]$ .  $N_b$  and  $N_a$ 

are electrons in bonding and antibonding molecular orbitals respectively.

For bond fermation, B.O. > 0

B.O. = 1/2, unstable but exists. B.O. of 1, 2, or 3 means single, double or triple bond

respectively. Bond length ∞-

bond order

Bond strength ~ bond order

Unpaired electron(s) means species is paramagnetic O If two diatomic species have equal number of electrons, they have equal bond orders with exception of CO+, e.g., N2 and CO have 14 electrons and bond order = 3. N2\*, 13e\*, has bond order = 2.5

while CO\*, Be has bond order = 3.5. Two species may have same bond order even when they do not have equal number of electrons. e.g., H, (2e') and F, (18e') have same bond order

More the number of lone pairs on the bonded atom.

 $-\ddot{N} - \ddot{N} - > - \ddot{O} - \ddot{O}$  Higher the percentage of s-character in b smaller is the bond length

weaker is the bond, e.g.,

1. Which of the following is correct according to

valence bond theory? (a) H,+ can exist. (b) Bond dissociation energy of CO\* is higher than that of CO molecule.

O, molecule is paramagnetic. (d) None of these 2. Molecular orbital theory was initially given by

(a) Mulliken (b) Lenard (d) Lewis and Kossel. (c) Pauling

3. Which of the following is not correct according to MOT? (a) Electrons of valence shell of an atom form major

bonds than other electrons.

(b) During the formation of molecular orbitals, atomic orbitals lose their identity. (c) Two atomic orbitals combine to form two molecular

cebitale (d) Bonding molecular orbitals have lower energy

than antibonding molecular orbitals.

4. Select the correct statement of the following for Aufbau principle for MOT:

(a) For 1 to 15 electrons the position of σ2p, is  $\pi 2\rho_{x} = \pi 2\rho_{x}, \pi^{*}2\rho_{x} = \pi^{*}2\rho_{x}, \sigma 2\rho_{x}, \sigma^{*}2\rho_{x}$ 

(b) For O2, N2 and F2 the correct position of σ2p, is ..., m2px = m2py, m2py, m\*2px = m\*2py

(c) For CO related cases or 2s is correctly placed as ...,  $\pi 2 \rho_s = \pi 2 \rho_s$ ,  $\sigma 2 \rho_s$ ,  $\sigma^* 2 s$ ,

(d) All of these are correct. 5. The electron probability between nuclei of two

bonded atoms is higher than the sum of probabilities for individual atoms by

(a) W, W

cl 20, 9, Which of the following molecular orbital has only one nodal plane! Ø25 (b) σ2ρ, (c) π2ρ, (d) π\*2ρ,

Which of the following has two nodal planes? (b) σ\*2pz (c) π2px (d) π\*2py Which of the following molecular orbital has three

lohes? (a) m2s (b) σ2p, (c) π2p, (d) π\*2p, Mathematically, bond order is equal to

(b)  $\frac{1}{2}[N_b - N_a]$ (a) 2IN - N. (d)  $\frac{1}{2}[N_b^2 - N_a^2]$ 

10. Which of the following is correct for bond order (B,O.)? (a) For the formation of bond, B.O. must be a whole

number (b) Fractional bond order means that the species does not exist.

(c) For B.O. = 1 2 3, the decreasing order of bond length is A > B > C.

(d) For B.O. = 1 2 3 the decreasing order of bond strength is A > B > C.

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	Which of the	Gillandan Ind	Nil-de e	to have same bond
	er as No molec		iikeiy i	to mave same bond
(a)			CN	

(c) O; (d) All of these 12. For the deavage of A - A bond which of the

following requires lowest energy?

(a) - C - C-(b) -Ö-Ö-(c) :F - F: (d) -N-N-

13. Which of the following C - C bond has the

smallest bond length? (a) -C-C= (h) -C-C

(d) C-C= (c) =C-C= 14. Which of the following represents the correct

decreasing order of bond dissociation energy? (b) Ho > Ho > Ho (a) Ho > Ho > Ho (c) H, > H, > H, (d) H, > H, > H,

15. Which of the following MO is being represented by the following diagram?

(b) x\*20. (a) π20. (d) None of the 

16. Bend order of NO is 2.5 while that of NO is Which of the following statements is true for these two

species? (a) Bond length, NO+ > NO

(b) Bend length is unpredictable (c) Bend length, NO = NO

(d) Bond length, NO > NO 17. Which of the following is diamagnetic? (a) H, (b) N,

(c) O2 (d) All of these In which of the following, the bond order increases

and the magnetic behaviour also changes? (a) H<sub>2</sub> → H<sup>+</sup> (b) CO → CO\*  $NO \rightarrow NO$ (d) All of these 19. Which of the following has double bond and both

the bonds are x-bonds? (a) H2 (b) C2 (d) None of these

20. The correct order of increasing C - O bond length

is shown in

(a) CO < CO<sub>2</sub> < CO<sub>3</sub><sup>2-</sup> (b) CO<sub>3</sub><sup>2-</sup> > CO<sub>3</sub> > CO (c) CO<sub>3</sub> < CO<sub>3</sub><sup>2</sup> < CO (d) CO<sub>3</sub> > CO > CO<sub>3</sub><sup>2</sup> 21. O - O bend lengths in O. O.(AsF.) and KO. in increasing order are

(a) O-(AsE-) < O- < KO- (b) KO- < O-(AsE-) < O-(c) O2 < KO2 < O2 (AsE4) (d) KO2 < O2 < O2 (AsE4)

22. Assuming 2s - 2p mixing is NOT operative, the paramagnetic species is

(a) Be<sub>2</sub> (b) B<sub>2</sub>

23. The correct increasing order of bond length for different species related to N2 is shown in (b) N<sub>2</sub> < N<sub>2</sub> < N<sub>3</sub> (a) N<sub>2</sub> < N<sub>2</sub> < N<sub>2</sub>

(d) N<sub>2</sub> = N<sub>2</sub> < N<sub>2</sub> (c) N2 < N2 = N20 24. The correct increasing order of stability for

different species related to O2 is shown in (a) O; < O; < O, < O, \* O, \* O, 2\*

(b)  $O_2^- < O_2^{-2} < C_3 < O_2^{-2} < O_2$ (c)  $O_3^- = O_2^{-2} < O_3 < O_2^{-2} = O_2$ (d)  $O_3^- < O_2^- < O_2 < O_2^- < O_2^-$ 

 The correct bond order of P — O bond in PO<sub>4</sub> in (c) 1.50 (d) 2.5

SOLUTIONS

2. (a) a): All electrons of combining atoms take part in the formation of bonds equally.

4. (c): For 1 to 15 electrons.  $\pi 2p_x = \pi 2p_y, \sigma 2p_y$ . For O2, N2 and F3.

... o2p., n2p. = n2p., ... The option (c) is correct.

5. (c):  $\Psi_{BMO} = \Psi_A + \Psi_B$  $\psi^{2}_{NMO} = (\psi^{2}_{A} + \psi^{2}_{R}) + 2\psi_{A}\psi_{R} \text{ (extra)}$ (c): σ2s and σ2p, have no nodal plane. π\*2p, has

two nodal planes. #2p, has one nodal plane. (d): σ1s has no nodal plane. σ\*2p, and π2p, both have one nodal plane each. x\*2p, has two nodal planes.

8. (b) 9. (b)

the idea first occurs

Quotable Quote In science the credit goes to the man who convinces the world, not to the man to whom

Sir Francis Darwin

11. (d): No. CO, CN and O2 all has 14 electrons

each. Hence, their bond order are equal. 12. (c): C, N, O and F all belongs to the same period (2<sup>rd</sup>) and their radii decrease in the same order. :F — F:

atoms are closest and have 3 lone pairs each. The overall repulsion being very high, F- bond dissociation energy is the lowest.

13. (c): Here, both the C-atoms are sp-hybridised having highest s (percentage) character, thereby smallest bond length.

14. (d):			
	H2 (2e)	H2 (1 e )	H2 (3 €)
MO electronic configuration	σls²	σls <sup>1</sup>	σls², σ°ls¹
$B.O. = \frac{1}{2}[N_b - N_a]$	1	0.5	0.5

H. has strong bond. Though H. and H. both have 0.8 B.O., yet H. has weaker bond because of the presence of one electron in ABMO (destabilising factor)

16. (d): Higher the bond order, smaller is the bondlength.

17. (d): H2 (2e): σ1s2

N, (14e"): 01s2, 0\*1s2, 02s2, 02s2  $O_1^{2+}(14e^2): \sigma 1s^2, \sigma^*1s^2, \sigma 2s^2, \sigma^*2s^2, \sigma 2p_s^2, \pi 2p_s^2 = \pi 2p_s^2$ 

H,\* (1e"): G1s1, B.O. - [1-

Bend erder decreases CO (14e<sup>2</sup>):  $\sigma(s^2, \sigma^*)s^2, \sigma(s^2, \pi(s^2)) = \pi(s^2, \sigma(s^2)) = \pi(s^2, \sigma(s^2))$  $B.O_{\nu} = -[10 - 4] = 3$  $CO^{+}(15e^{+}): \sigma 1s^{2}, \sigma^{+}1s^{2}, \sigma 2s^{2}, \pi 2p_{\pi}^{2} = \pi 2p_{\pi}^{2}, \sigma 2p_{\pi}^{2}$ 

σ\*2s2, π\*2p, B.O. = -[10-5] = 2.5 : B.O. decreases NO (15e):  $\sigma_{1s^2}$ ,  $\sigma_{1s^2}$ ,  $\sigma_{2s^2}$ ,  $\sigma_{2s^2}$ ,  $\sigma_{2s^2}$ ,  $\pi_{2p_s^2} = \pi_{2p_{ss}^2}$ 

B.O. =  $\frac{1}{2}[10-5] = 2.5$ ; paramagnetic

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 $NO^{+}(14e^{-}): \sigma 1s^{2}, \sigma^{+}1s^{2}, \sigma 2s^{2}, \sigma^{+}2s^{2}, \pi 2s^{2} = \pi 2s^{2},$ 

B.O. = -[10-4] = 3, diamagnetic; B.O. increases

19. (b):  $H_2^{2-}(4e^-)$ ;  $\sigma 1s^2 \sigma^* 1s^2$ : B.O. =  $\frac{1}{2}[2-2]=0$ ;

C+ (1247) : #12, #112, #22, #22, #24

B.O. = -[8-4]=2 ⇒ double bond Last 4 electrons are paired in two # molecular orbitals.

Hence, both the bonds of this double bond are  $\pi$ -bonds.  $O_{\tau}(16e^{\tau}): \sigma 1s^{2}, \sigma^{*}1s^{2}, \sigma 2s^{2}, \sigma^{*}2s^{2}, \sigma 2p_{\tau}^{2}, \pi 2p_{\tau}^{2} =$  $\pi 2p^2$ ,  $\pi^* 2p^1 = \pi^* 2p$ .

B.O. = -[10-6] = 2 - double bond 20. (a) : C = 0 : Bond order = 3

C=0; Bend order =  $\frac{1}{2}(2+2)=2$  $-c^{\circ}$ ; Bend order =  $\frac{(2+1+1)}{2} = \frac{4}{2} = 1.33$ 

Higher the bond order, smaller is the bond length.

21. (a): O<sub>2</sub>(AsF<sub>4</sub>) has O<sub>2</sub>\* with B.O. = 2.5 O+ has B.O. = 2 KO, has O, with B.O. = 1.5

Bond length: O<sub>2</sub>(AsF<sub>6</sub>) < O<sub>2</sub> < KO<sub>2</sub>

22. (c): When 2s-2p mixing is not operative the molecular orbitals in increasing energy will be given as fellows : Be, (8e"): σ1s2, σ\*1s2, σ2s2, σ\*2s2; Diamagnetic

B,(10ε\*): σ1s2, σ\*1s2, σ2s2, σ\*2s2, σ2ρ,2; Diamagnetic C.(12e): 01s2, 0\*1s2, 02s2, 0\*2s2, 0202, 7201 = 7201;  $N_2(14e^2)$ :  $\sigma 1s^2$ ,  $\sigma^2 1s^2$ ,  $\sigma 2s^2$ ,  $\sigma^2 2s^2$ ,  $\sigma 2p^2$ ,  $\pi 2p_s^2 = \pi 2p_s^2$ ;

25. (b): Bend order of P — O bend in 
$$= \frac{2+1+1+1}{0} = \frac{5}{2} = 1.25$$

Diamagnetic

σ2p, π 2p,

**CLASS XI** 



### tice paper for CBSE Exams as per the latest pattern and marking scheme issued by CBSE for

the academic session 2018-19.

Time Allowed: 3 hours

GENERAL INST All questions are compulsion

ractice Paper 2019

- (ii) Section A: Onc. 1 to 5 are very short answer questions and game I mark each
- (iii) Section 8: Qino 4 to 12 are short ansiver questions and carry 2 marks each (h) Section C: Qing. 13 to 24 are also short answer curestors and cury 3 maio s
- (v) Section It Qing 25 to 27 are long answer questions and care 5 mails each (bit) Then is no ownell choice However an internal choice has been provided in two cuspions of one mark, two questions of two marks, four cuspions of three
- marks and all the three questions of five marks well have to literage only one of the choices in such cuestions (viii) Use for tables if necessary, use of calculaton is not allowed

SECTION-A

Can Fe3+ oxidise Br\* to Br, at 1 M concentrations?  $E^*(Fe^{3+}|Fe^{2+}) = 0.77 \text{ V and}$ 1. Name the two experimental phenomenon which  $E^{*}(Br_{-}|Br_{-}) = 1.09 \text{ V}$ can be explained by the wave nature of the

electromagnetic radiation. 2. Define melarity of a solution. Give its SI units.

- Why do we prefer molality over molarity?
- 3. Write an expression for Boyles' temperature and critical temperature in terms of van der Waals' constants. Which one is larger for a particular gas?
- 4. In terms of electronic configuration, what the elements of a given period and a group have in common?
  - OR A student reported the radii of Fe. Fe2s and Fe2s as 117 pm, 64 pm and 76 pm respectively. Do you agree with the reported values? Justify the answer.
- 13.6 eV/atoms. But it requires a photon of energy 1.5 times the minimum energy required to remove the electron. Calculate the kinetic energy of the ejected electron in joule per mole. State the first law of thermodynamics for (i) an adiabatic process

6. The ionization energy of H-atom is

SECTION-B

(ii) a system undergoing a change in which internal energy remains constant. The first  $(IE_1)$  and the second  $(IE_2)$  ionization

enthalpies (kl/mol) of a few elements designated by Roman numerals are shown below:

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Maximum Marks: 70

Element 1		IE <sub>2</sub> 5251
11	520	7300
111	900	1760
IV	1680	3380

Which of the above elements is likely to be

- (i) a reactive metal
- (ii) a reactive non-metal (iii) a noble gas
- (iv) a metal that forms a stable binary halide of the formulae  $AX_3$  (X = halogen).
- Consider the following species:
- N3-, O2-, F', Na+, Mg2+ and Al3+
- (i) What is common in them? (ii) Arrange them in the order of increasing ionic radii.
- 9. Complete the following reactions: ZnO, Cr2O,
  - (i) CO + H<sub>2</sub> 200 atm, 675 K (ii) SiC2 + NaOH ---->
- 10. What are the possible structures for a carboxylic acid with a molecular formula C4HgO2 and label each C atom as sp, sp2 and sp3?
- 11. For the equilibrium.  $2NOCl_{(e)} \Rightarrow 2NO_{(e)} + Cl_{2(e)}$ the value of equilibrium constant is  $K_1 = 3.75 \times 10^{-6}$ 
  - at 500 K. Calculate the value of K, at this temperature. How can you predict the following stages reaction by comparing the value of K, and Q.
  - (i) Net reaction proceeds in the forward direction. (ii) Net reaction proceeds in the backward direction. (iii) No net reaction occurs.
- 12. Although both CO, and H<sub>2</sub>O are triatomic molecules, the shape of H<sub>2</sub>O molecule is bent while that of COs is linear. Explain this on the basis of dipole moment.
- ses of the compounds represented by
  - e following bond-line notations
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- 14. Certain amount of a gas occupies a volume of 400 mL at 17°C. To what temperature should it be heated so that its volume gets foldersh (i) (iii) reduced to half?
- When water is added to compound (A) of calcium. solution of compound (B) is formed. When carbon dioxide is passed into the solution, it turns milky due to the formation of compound (C). If excess of
- carbon dioxide is passed into the solution, milkiness disappears due to the formation of compound (D). Identify the compound A. B. C and D. Explain why the milkiness disappears in the last step?
  - OF Comment on each of the following observations: (i) The mobilities of the alkali metal ions in acureous solution are la " < Na " < K" < Rb" < Cs"
  - (ii) Lithium is the only alkali metal to form a nitride directly
  - III)  $E^n$  for,  $M_{loc}^{2n} + 2e^- \longrightarrow M_{loc}$ (where M = Ca. Sr or Ba) is nearly constant.
- 16. Give reason: (i) Red phosphorus is less reactive than white phesphorus
  - H-PO- undergoes disproportionation reaction but H,PO, does not (iii) PCl, gives fume in moisture.
- 17. (i) What is the formula of a compound in which the element Y forms ccp lattice and atoms of X occupy 1/3<sup>rd</sup> of tetrahedral voids?
  - (ii) Aluminium crystallises in a fcc structure. Atomic radius of the metal is 125 pm. What is the length of the side of the unit cell of the metal?
    - (a) (i) What type of non-stoichiometric point defect is responsible for the pink colour of
  - (ii) What type of stoichiometric defect is shown by NaCl? (b) Why in steichiometric defects, NaCl exhibits
- Schottky defect and not Frenkel defect? 18. (i) Define heat capacity of the system.
  - (ii) Calculate difference between Cp and Cy for 10 moles of an ideal gas. (iii) If the combustion of 1 g of graphite produces 20.7 kl of heat, what will be molar enthalpy
- change? Give the significance of sign also. 19. A solution of 0.2 g of a compound containing Cu2+ and C.O. ions on titration with 0.02 M KMnO. in

presence of H<sub>2</sub>SO<sub>4</sub> consumes 22.6 ml. of the oxidant. The resultant solution is neutralized with Na<sub>2</sub>CO<sub>3</sub> acidified with Ial, acetia cold and treated with excess KI. The liberated iodine requires 11.3 ml. of 0.05 M Na<sub>2</sub>SO<sub>3</sub>, solution for complete reduction. Find out the mole ratio of Cus<sup>2</sup> to CQO<sup>2</sup> in the compeund. Write down the balanced redox reactions involved

- in the above titrations.

  20. A colourless liquid 'A' contains H and O elements only.

  It decomposes slowly on exposure to light, it is stabilised
  - by mixing urea to store in the presence of light.

    (i) Suggest possible structure of A.

    (ii) Write chemical equations for its decomposition
  - reaction in light.

Calculate the volume strength of a 3% solution of H<sub>2</sub>O<sub>2</sub>.

- Starting from SiCl<sub>4</sub>, prepare the fellowing :
   Silicon
- (ii) Linear silicone containing methyl groups only (iii) Na-SiO<sub>3</sub>
- On the basis of bond order, predict which of the species is the most stable? O<sub>2</sub>, O<sub>2</sub> or O<sub>2</sub><sup>o</sup>
   (i) Explain how ozone layer is destroyed by
  - chlerefluorocarbons.
    (ii) What is the difference between BCD
- COD? Which one is better and why?

  24. How would you convert the following comp
  - into benzene?
    - (iii) Hexane
    - OR Explain why the following systems are not aromatic
  - (i) CH<sub>2</sub> (ii) (iii) [
- SECTION-D

  25. (i) Define limiting reagent.
  - (ii) Chlorophyll, the green colouring matter of plants responsible for photosynthesis, contain 2.68% of magnesium by mass. Calculate the number of magnesium atoms in 2.00 g chlorophyll.
  - (iii) An alloy of iron (53.6 %), nickel (45.8 %) and manganese (0.6 %) has a density of 8.17 g cm<sup>-3</sup>. Calculate the number of Ni atoms present in the alloy of dimensions 10.0 cm × 20.0 cm × 15.0 cm.

## OR (i) The cost of table salt (NaCl) and table supar

- The cost of table salt (NaCl) and table sugar (C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>) is ₹ 2 per kg and ₹ 6 per kg, respectively. Calculate their costs per mol.
- (ii) A 1.00 g sample of limestone is allowed to react with 100.0 cm<sup>3</sup> of 0.20 mol L<sup>-1</sup> hydrochloric acid. The excess acid required 24.8 cm<sup>3</sup> of 0.10 mol L<sup>-1</sup> sodium hydroxide colution. Calculate the percentage of calcium carbovate.
- in the limestone.

  26. (i) Calculate the pH of a solution obtained by mixing equal volumes of two solutions with
  - mixing equal volumes of two solutions with pH = 3 and 5.

    (ii) The reaction, N<sub>2(s)</sub> + O<sub>2(s)</sub> \( \sum\_{n} \sum\_{n} \sum\_{n} \) 2NO<sub>(s)</sub> is in
  - equilibrium at a certain temperature. Can the amount of natric coade be increased in the equilibrium cristure by (a) adding catalyst
    - (b) increasing pressure?
      (b) Why does the gas fizz out when soda water bottle is opened?
  - OR

    (a) What indicators will be suitable for the
  - following acid-base titrations?

    (ii) HCOOH against NaOH
  - (ii) HCl against KOH and (iii)NH<sub>4</sub>OH against HNO<sub>3</sub> (b) The ionization constant of ammonium
- hydroxide is 1.77 × 10<sup>-5</sup> at 298 K. Calculate the hydrolysis constant of ammonium chloride and pH of 0.04 M ammonium chloride solution.
- (a) What happens when
   (i) becomethane is treated with zinc and hydrochloric acid
  - (ii) hydrogen is passed into 2-bromopropane in the presence of palladium?
  - (b) Complete the following reactions:
- (i) CH<sub>2</sub>CH<sub>2</sub>Bt = sk. KOH → (ii) CH<sub>2</sub>CH = CH<sub>2</sub>+O<sub>3</sub> = ZaVt<sub>2</sub>O → (iii) CH<sub>2</sub> = CH<sub>2</sub>+H<sub>2</sub>O +[O] = dd. KMnO<sub>4</sub>
- OR
  (a) Complete the following reactions:
  - (i) HC =CH NaNii2,Cli3lir→A
  - (ii)  $HC \equiv CH \xrightarrow{H_2C,H_2SO_4H_2SO_4} B$ (iii)  $CH_2C \equiv CH + H_1 \xrightarrow{PV | Pd/Ni)} C \xrightarrow{H_2} D$
  - (b) Out of benzene, m-dinitrobenzene and toluene, which will undergo nitration most easily and why?

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### SOLUTIONS

- 1. (i) Diffraction
- (iii) Interference 2. Molarity is defined as the number of moles of solute per litre of the solution. Its SI unit is mol L-1.
- Molality is preferred over molarity as it is unaffected by temperature.
  - Boyle's temperature, T<sub>B</sub> = <sup>41</sup>/<sub>12</sub>
- Critical temperature,  $T_C = \frac{8a}{ann}$
- : T<sub>R</sub> > T<sub>C</sub>
- 4. For elements in a period the number of shells is same and for elements in a group the number of electrons in the outermost shell (valence shell) is the
- No. As positive charge increases on metal ion ionic
- radius decreases and hence, reported radii are not true
- E'(Fe<sup>3+</sup> | Fe<sup>2+</sup>) is lower than that of E'(Br, | Br) Therefore, Fe2+ can reduce Br> but Br cannot reduce Fe3+ Thus, Fe3+ cannot exidise Br to Br
- 6. W = 13.6 eV/atem

same.

- Energy of the incident photon = hy
- = 1.5 × W = 1.5 × 13.6 eV : hv = W + KE : KE = hv - W = (1.5 × 13.6) - 13.6
- KE = 6.8 eV/atomKE = 68 × 1.6 × 10<sup>-29</sup> × 6.02 × 10
- = 654.976 × 103 J/mol 7. (i)  $\Delta U = q + w$
- For an adiabatic process q =
- $\Delta U = w$ The change in internal energy is equal to the work done on the system
- (iii)  $\Delta U = 0$ , so -w=+q
- Heat absorbed by system is used in doing work.
- (i) A reactive metal → Element II (Lithium)
- (ii) A reactive non-metal → Element IV (Fluorine) (iii) A noble gas → Element I (Helium) (iv) A metal that forms a stable binary halide of the
- formulae AX- is Element III (Bervllium, BeX-).
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- (i) All these are isoelectronic species as they are having same number of electrons i.e., 10
- (ii) As Z/e decreases, size increases so, order should be, N3->02->F>Na+>Mg2+>Al3+.
  - $Z_{100, Ci_2O_3} \rightarrow CH_3CH$ (i) CO + 2H<sub>3</sub> -
- (ii) SiO<sub>2</sub> + 2NaOH Na<sub>2</sub>SiO<sub>4</sub> + H<sub>2</sub>
- 10. The possible structures for a carboxy

- $K_n = K_s(RT)$ a,=3-2=1  $K_{\bullet} = 3.75 \times 10^{-4} \times (0.083 \times 500)$
- = 1.55625 × 10<sup>-6</sup>
- If O. < K., net reaction proceeds in forward
- ii) If Q. > Kp net reaction proceeds in backward direction. (iii) If O. = K., no net reaction occurs. Reaction is at
  - equilibrium. 12. Even though both CO<sub>2</sub> and H<sub>2</sub>O are triatomic, but CO. has zero dipole moment. It implies that CO. has a symmetrical structure which is possible only when
  - it is linear. However, H2O has a net dipole moment suggesting that the molecule is non-linear.
  - 13. (i) buta-1, 3-diene (ii) 4-methylpenta-1, 3-diene (iii) but, Len, Lyne
- (iv) 4-ethylhex-4-en-2-ol (v) 3-ethyl-4-methylhex-4-en-2-one
- (vi) 2, 3, 4-trimethylbex-1-en-3-ol
- 14. (i) V<sub>1</sub> = 400 ml  $V_2 = 2 \times V_1 = 800 \text{ mL}$
- T<sub>1</sub> = 17°C = (17 + 273.15) K = 290.15 K

From the Charles' law,  $\frac{V_1}{T} = \frac{V_2}{T}$  or  $T_2 = \frac{V_2}{V} \times T_1$ 

800 mL×290.15 K = 580.3 K 400 mL or T<sub>2</sub> = (580.3 - 273.15)\*C = 307.15 \*C

(ii)  $V_1 = 400 \text{ mL}$ 

 $V_2 = \frac{1}{2} V_1 = 200 \text{ mL}$ 

 $T_1 = 290.15 \text{ K}$ 

 $V_2 \times T_1 = 200 \text{ mL} \times 290.15 \text{ K}$ =145.07 K V. 400 mI.

or T<sub>2</sub> = (145.07 - 273.15)°C = -128.08 °C 15. Appearance of milkiness on passing CO2 in the

solution of compound B indicates that compound B is lime water and compound Cis CaCO s. Since, compound B is obtained by adding H-O to compound A, therefore compound A is quicklime, CaO. The reactions are as follows :

(milkiness) (iii) When excess of CO2 is passed, milkiness disappe due to the formation of soluble calcium

CaCO, + CO, + H,O -> Ca(HCO<sub>4</sub>), Calcium Near ho

carbenate (6

(i) Although smaller ions are expected to be more mobile and, therefore, the mobility of smaller ions should be greater. But smaller ions such as Li\*, Na\* due to their higher charge density tend to undergo hydration. Hydration increases the mass and effective

size of the smaller son, and as a result, the values of the mobility follow the trend as Li\* < Na\* < K\* < Rb\* < Cs\*

(ii) Lithium forms lithium nitride (Li<sub>0</sub>N) which is an ionic compound. The formation of N3" ion requires a lot of energy. This energy is provided by very high lattice enthalpy of Li-N

due to very small size of Li\*. (iii) E value of any metal depends upon enthalpy of sublimation, (endothermic), enthalpy of ionisation (endothermic) and enthalpy of hydration (exothermic). The enthalpies of sublimation and ionisation decreases. whereas the enthalpy of hydration increases (becomes less negative) as we go down the group. These quantities counterbalance and as a result, E' values for  $M_{(44)}^{2+} + 2e^- \rightarrow M_{(4)}$  (M = Ca, Sr, Ba) are nearly the same.

16. (i) White phosphorus is made up of discrete P4 tetrahedra which are subjected to very high angular strain as the angles are 60°. Red phosphorus is a polymer of P4 tetrahedra, which has much less angular strain.

This high angular strain makes white phosphorus unstable and highly reactive (ii) The exeacid of phosphorus containing +3 exidation state, undergoes disproportionation to yield compounds in higher and lower oxidation states. Hence, H<sub>3</sub>PO<sub>3</sub>

undergoes disproportionation reaction but H4PO4 does not, as in it phosphorus is already in highest exidation state (+5) (iii) PCI, hydrolyses in the presence of moisture giving

fumes of HCL

PCI. + 3H-O -> H-PO- + 3HCI

7. (i) No. of Y atoms per unit cell = -x8+-x6=4 No of tetrahedral voids =  $2 \times 4 = 8$ 

No. of X atoms =  $\frac{1}{-\times 8}$  = Formula of the compound =  $X_*Y_* = X_7Y_5$ 

(ii) NaCl crystal shows Schottky defect.

(ii) For fcc (or ccp), a = 2√2r = 2 × 1.414 × 125 pm = 354 pm

(a) (i) Metal excess defect is responsible for pink colour of LiCl. It is also known as anion vacancy defect.

(b) Since Schottky defect is shown by highly ionic compounds having small difference identical in the size of cations and anions, whereas Frenkel defect is shown by compounds having large difference in the size of cations and anions. Therefore, NaCl exhibits Schottky defect.

18. (i) Heat capacity of the system is defined as the quantity of heat required to raise the temperature of the system by one degree. This is denoted by C, (at constant volume) and C, (at constant pressure). So, heat capacity =

(ii) For 10 moles of an ideal gas  $C_P - C_V = nR = 10 \times 8.314 J = 83.14 J$ 

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- (iii) Molar enthalpy change for graphite (ΔΗ) = enthalpy change for 1 g × molar mass of C  $= -20.7 \times 12 = -2.48 \times 10^{2} \text{ kJ mol}^{-1}$
- Since the sign of  $\Delta H = -ve$ , it is an exothermic reaction. 19. The chemical equation involving the titration of
- C2O4" with MnO2 is  $2MnO_4^+ + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_3 + 8H_3O_3$
- The chemical equations involving Cu2+ ions are  $2Cu^{2+} + 4\Gamma \longrightarrow Cu_3I_3 + I_3$
- $1_2 + 2S_2O_1^2 \longrightarrow 2\Gamma + S_2O_2$ The stoichiometry of the above reactions give
- 2 mol MnO4 = 5 mol C2O4 2 mol S<sub>2</sub>O<sub>3</sub><sup>2-</sup> m 1 mol of I<sub>2</sub> m 2 mol Cu<sup>2+</sup> Therefore, amount of C2O4 in the solution
- 0.02 mol = 1000 mL × 22.6 mL × = 1.13 × 10<sup>-3</sup> mel
- and amount of Cu2+ in the solution
- 0.05 mol × 11.3 mL = 0.56 × 10<sup>-3</sup> mol 1000 ml Amount of Cu2+ 0.56×10<sup>-3</sup> mol 1
- Amount of C,O2-1.13×10<sup>-1</sup> mol 2 20. (i) The liquid A is hydrogen perexide (H2O2)
- In H2O2, the two oxygen atoms are linked to each other by single bond (peroxide) and each oxygen is further linked to H atom by single bond. The two C-H bor
- are in different plane, giving H.O. a non-pla
- (ii) 2H<sub>2</sub>O<sub>244</sub>  $O_{NA}:\Delta H = -196 \text{ kJ}$ 100 mL of  $H_2O_2$  solution centains  $H_2O_2 = 3g$ 1000 mL of H.O. solution will contains
- $H_2O_2 = \frac{3}{100} \times 1000 = 30 \text{ g}$ 
  - Consider the chemical equation, 2H,O, ->2H,O+O 2×34-68g
    - Now 68 g of H<sub>2</sub>O<sub>2</sub> gives O<sub>2</sub> at NTP = 22.4 L : 30 g of H<sub>2</sub>O<sub>2</sub> will give O<sub>2</sub> at NTP = 22.4 × 30 = 9.88 L

- But 30 g of H2O2 are present in 1000 mL of H2O3. Hence, 1000 mL of H-O- solution gives O- at NTP = 9880 mL 1 mL of H<sub>2</sub>O<sub>2</sub> solution will give O<sub>2</sub> at N.T.P.
- 9880 = 9.88 mI
- Hence, the volume strength of 3% H<sub>2</sub>C (i) SiCl<sub>4</sub> + 2Mg → Si + 2MgC (ii) 2CH<sub>2</sub>Cl + Si Cu
  - Methyl chloride CI-Si-CI+2H-O ĊH,
- · CH<sub>2</sub> his type of poon continues at both ends to
- 2 + 2NaOH High Na2SiO3 + H2O The number of electrons in each species and the
- corresponding MO configuration are Species Total MO configuration Bond

	no. of electrons		order
O <sub>2</sub>	17	$(\sigma 1s)^2 (\sigma^* 1s)^2 (\sigma 2s)^2$ $(\sigma^* 2s)^2 (\sigma 2p_g)^2 (\pi 2p_g)^2$ $= (\pi 2p_g)^2 (\pi^* 2p_g)^2$ $(\pi^* 2p_g)^4$	(10 = 7)/2 = 1.5
02	16	$(\sigma_1 s)^2 (\sigma_1 s)^2 (\sigma_2 s)^2$ $(\sigma_2 s)^2 (\sigma_2 p_g)^2$ $(\pi_2 p_g)^2 = (\pi_2 p_g)^2$ $(\pi_2 p_g)^2 = (\pi_2 p_g)^2$	(10 - 6)/2 = 2.0
O <sub>2</sub> *	15	$(\sigma 1s)^2 (\sigma 1s)^2 (\sigma 2s)^2$ $(\sigma 2s)^2 (\sigma 2\rho_a)^2 (\pi 2\rho_a)^2$ $= (\pi 2\rho_a)^2 (\pi 2\rho_a)^2$	(10 = 5)/2 = 2.5

The species having the highest bond order is the most stable. So, O5 is the most stable out of the given species. 23. (i) In the stratosphere, CFCs first undergo photochemical decomposition to give chlorine atoms or free radicals.

= 9880 mL CF.G. by CF.G+CI



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...(ii)

CFCL - by CFCL + CI

The reactive chlorine atoms then destroy the ozone layer through the following sequence of reactions which are repeated over and over again because chlorine atoms are regenerated in the second reaction, i.e.,

CI+C1 → CIO+C2

CIO+0-CI+01 \_(10) It has been found that one molecule of CFCs can destroy more than one thousand O. molecules in the

stratosphere. (ii) COD is closely related to BOD, the difference being that BOD is a test of the level of organic matter that can be biologically exidised while COD is a test of the amount of creanic matter that can be chemically oxidised. COD is better estimate of organic matter which needs no saponification and is time saving.

(ii) 
$$CH_2 = CH_2 \xrightarrow{Be_2} CH_2 - CH_2 \xrightarrow{ale \ KOH}$$
  
Ethene  $Be$ 

One of the conditions stated by the Huckel's rule for any system to be aromatic is that of planarity i.e., all atoms of the molecule must be present on the same plane. This rule is violated in structure (i) and (ii). The carbon atom indicated below are sp3 hybridised which disallow planarity (sp hybridised carbon is tetrahedral

In (iii) the number of n electrons is 8. (2 per double bond). The Huckel's rule allows 2, 6, 10, 14, ... etc. π electrons for any aromatic system. Since (iii) does not have  $(4n + 2)\pi$  electrons, therefore, it is not aromatic.

25. (i) The reactant which gets consumed in a reaction and limits the amount of product formed is called limiting reagent.

(ii) Chlorophyll contains 2.68% by mass of magnesium which means 100 g chlorophyll contains 2.68 g of Mg

∴ 2.00 g chlorophyll contains 2.68 × 2g Mg

Number of moles of Mg = 
$$\frac{2.68 \times 2}{100 \times 24}$$
 = 2.23 × 10

Number of Mg atoms = 
$$2.23 \times 10^{-3} \times 6.022 \times 1$$
  
=  $1.34 \times 10^{21}$ .

Mass of the alloy - density x volu = (8.17 g cm<sup>-3</sup>) × (3000 cm<sup>3</sup>) = 24510 g

Mass of Ni in the alloy =  $(24510 \text{ g}) \times \frac{45.8}{100} = 11225.6 \text{ g}$ 

Cost of NaCi per mol = 
$$\frac{2}{1000} \times 58.5 = ₹ 0.117$$
  
= 11.7 paise or 12 paise

One mole of sugar 
$$(C_{12}H_{22}O_{13}) = 342 \text{ g}$$
  
Cost of sugar per mol =  $\frac{6}{1000} \times 342 = ₹2.05$ 

(ii) 
$$CaCO_{N(d)} + 2HCl_{(ad)} \rightarrow CaCl_{2(ad)} + H_2O_{(f)} + CO_{2(g)}$$

Number of moles of 
$$CaCO_3 = \frac{1}{2} \times \text{number of moles}$$
  
of  $HCI$   
Total number of moles of  $HCI = M_{MCI} \times V_{MCI}$ 

= 0.20 mel L<sup>-1</sup> × 100.0 × 10<sup>-5</sup> L = 0.02 mol The excess HCl is neutralised by NaOH. The reaction is  $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$ 

= 0.10 mel L-1 × 24.8 × 10<sup>-3</sup> L = 0.00248 mel Number of moles of HCl neutralised by CaCO,

= Total n<sub>HCI</sub> - Excess n<sub>HCI</sub> = 0.02 - 0.00248 = 0.01752 mol

From the equation,  $n_{GCO_1} = \frac{1}{2}n_{HG}$ 

 $=\frac{1}{2}\times0.01752=0.00876$  mel

Mass of  $CaCO_3 = n_{CaCO_n} \times Molar mass$ = 0.00876 × 100 = 0.876 g

% of CaCO<sub>3</sub> in the limestone =  $\frac{0.876}{1.00} \times 100 = 87.6$  %

26. (i) Here, pH = 3 means [H+] = 10-3 M and pH = 5 means [H\*] = 10-5 M On mixing equal volumes of these two solutions, we

 $[H^+] = \frac{(10^{-3} + 10^{-5})}{2}$ 

= 0.505 × 10<sup>-3</sup> M

: pH = -log (5.05 × 10<sup>-4</sup>) = 4 - 0.7033 = 3.3 (ii) (a) No. because the catalyst does not change

equilibrium concentrations. (b) Pressure has no effect on this equilibrium because

the number of moles of gaseous products is equal to the number of moles of gaseous reactants. (iii) Soda water is aqueous solution of CO<sub>2</sub> in which CO2 gas is disselved under high pressure. On opening a soda water bottle, pressure is released and therefore.

(a) (i) Phenolphthalein and thymol blue are suitable indicator for weak acid and strong base titration. (ii) Phenolphthalein, bromothymol blue and methy orange are suitable indicator for the titration of strong acid and strong base.

(iii) For weak base and strong acid titration, methyl orange and methyl red are the most suitable indicators. (b) NH<sub>2</sub>Cl is a salt of weak base and strong acid. Therefore, only the cation will hydrolyse to give acidic solution and

$$K_h = \frac{K_w}{K_b} = \frac{1.0 \times 10^{-14}}{1.77 \times 10^{-3}} = 5.65 \times 10^{-1}$$
  
and  $pH = 7 - \frac{1}{1.00} (\log 6 + pK_b)$ 

dissolved CO, fizzes out.

 $pH = 7 - \frac{1}{2} [\log 0.04 + (-\log 1.77 \times 10^{-5})]$ 

 $(-1.40 + (4.75)) = 7 - \frac{1}{2} \times (3.35) = 7 - 1.675$ 

: pH = 5.325 27. (a) (i) Ethane is formed

Zn/HCl (Reduction) CH<sub>3</sub> --CH<sub>3</sub> + HBr CH,CH,-Br -

Bromorthune

(iii) Propage is obtained

2-Roomere (b) (i) CH-CH-Br

CH<sub>2</sub> = CH<sub>2</sub>+ KBr + H<sub>2</sub>C

(ii) CH<sub>2</sub>CH = CH<sub>2</sub> + O<sub>3</sub> → CH<sub>2</sub>CI

CH-CHO + HCHO (iii) CH2=CH2+H2O+

CH, -CH OH OH

Ethane-I, 2-diel 12> HC≡CNa\*

CH<sub>3</sub>lr → HC ≡CCH<sub>3</sub> CH = CH -

(iii) CH<sub>3</sub>-C≡CH+H, Pt/Pd/Ni

CH<sub>3</sub>-CH=CH<sub>2</sub>-H<sub>3</sub>-CH<sub>3</sub>-CH<sub>2</sub>-CH<sub>3</sub> (b) Nitration is an electrophilic substitution reaction.

Since -CH<sub>3</sub> group is electron donating group, it increases the electron density on the benzene ring, thereby facilitating electrophilic substitution reaction. Nitro group on the other hand is electron withdrawing group, therefore, it is deactivating, i.e., decreases the reactivity towards electrophilic substitution reaction. Hence, the order of ease of nitration is:



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## PRACTICE PROBLEMS

## these practice problems enable you to self analyse your extent of understanding of specified chapter. Give volumely four marks for

correct answer and deduct one mark for wrong answer. Performance analysis table given at the end will help you to check your readiness. Total Marks: 120

Organic Chemistry - Some Techniques Time Taken: 60 Min.

## Only One Option Correct Type

- 1. Which comparison is not correct as indicated? OH > CH<sub>3</sub>OH (acidic nature)
- -NH<sub>2</sub> > CH<sub>2</sub>NH<sub>2</sub> (basic nature)
  - ·ČH, > CH,ČH, (stability)
- COH > CH, COH (ac
- 2. Give the stability order of the OCH,
  - m (a) 1>11>11>1V (b) IV NINIINIII (c) IV > I > III > II (d) IV > II > I > III Two elements X (atomic weight = 75) and Y (atomic
- weight = 16) combine to give a compound having 75.8% X. The formula of the compound is (a) XY (b) X2Y (c) X2Y2 (d) X2Y3 4. An ether solution of benzoic acid (4), aniline (8) and toluene (C) is extracted with aqueous NaOH.
- The ether layer will contain what compound(s) after the extraction? (a) A (b) A+B (c) B+C (d) A+C

Which of the following pairs are not functional

**Basic Principles and** 

- -CH+-CH+-CH+-C-H
- CH.-CH.-CH. III. CH, -CH, -C-CH, -CH,
- IV. CH<sub>3</sub>-CH-CH<sub>3</sub>-C-H
- (a) II and III (b) II and IV (c) I and III (d) I and II
- 6. Which of the following does not represent resonating structure of the given compound?

  - What is the correct IUPAC name of the compound shown below?

TRY TODAY | FERRUSE '19

- (a) 4-(2-Chlore-1, 2-dimethylpropyl)-3-methyloct -1-vne
- (b) 4-Butyl-6-chlore-3, 5, 6, 6-tetramethylhept
- -1-vnc
- (c) 4-Butyl-2-chloro-2, 3, 5-trimethylhept-6-yne
- (d) 4-Butyl-6-chloro-3, 5, 6-trimethylhept-1-yne 8. 0.3780 g of an organic chlore compound gave 0.5740 e of silver chloride in Carius estimation.
  - Calculate the percentage of chlorine present in the compound.
  - (a) 31.5 % (b) 37.6 % (c) 70.8% (d) 57.4 %
- 9. Electronegativity of carbon atoms depends upon their state of hybridisation. In which of the following compounds, the carbon marked with asterisk is
  - most electronegative? (a) CH3-CH2-CH2-CH3
  - (b) CH<sub>3</sub>-CH=CH-CH<sub>3</sub>
  - (c) CH<sub>3</sub>-CH<sub>2</sub>-C≡CH (d) CH.-CH.-CH=CH.
- 10. If a pure enantiomer of 1, 3-dichloropentane, shows below, is subjected to free radical chlorination to obtain trichloropentane, how many differ isomers would be formed?

(a) 7 (b) 5 11. Identify correct dipole

12112 (b) ii > iii > i (d) III > i > II

12. The absolute configurations of the Co and Co atoms in the molecule with the structure is

(a) 25, 35 (b) 2R, 3S (c) 25, 3R

(d) 2R, 3R

Assertion & Reason Type

Directions : in the following cuestions, a statement of assertion is followed by a statement of season. Mark the correct choice as :

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

- (b) If both assertion and reason are true but reason is not the
  - correct explanation of assertion.
- (c) If assertion is true but reason is take
- (c) If both assertion and reason are false 13. Assertion: Simple distillation can belo in separating a mixture of propan-1-ol (boiling point 97°C) and
  - propanone (boiling point 56°C). Reason: Liquids with a difference of more than 30°C in their boiling points can be separated by
- simple distillation. 14. Assertion: Relative reactivity towards electrophilic addition is
- Reason : Electron releasing group stabilizes carbocation More the +M effect, more is stability of
- Assertion: Sulphur present in an organic compound can be estimated quantitatively by Carius method. Reason: Sulphur is separated easily from other atoms in the molecule and gets precipitated as light

#### green solid JEE MAIN / ADVANCED

Only One Option Correct Type 16. The correct increasing order of basic strength of the labeled N is

(c) 1 < 1111 < 1V < 11 (d) IV < III < II < I 17. In which option the configurational naming is not correctly matched with the respective structure?

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18. Which of following represent (E)-3, 6-dibromo-6-methyl-3-heptenel

1.18 g of an organic compound gave 224 mL of N- at NTP. The percentage of nitrogen in the compound is about

(+) 20.0 (b) 11.8 (c) 47.5 (d) 23.7

More than One Options Correct Type 20. Which statements among following are corre (a) Hydration effect stabilise dimethyl an

ion more than trimethyl ammonium ior

(b) R-C-NH2 is more basic than R-C-(c) N<sub>1</sub> < CN" < CH<sub>2</sub>O" : nucleophilicity order in DMSO.

(d) Phenol is more acidic than CH+OH. 21. Which of the following compounds and their names

22. Hyperconjugation involves delocalisation of (a) electrons of carbon-hydrogen σ bond of an

alkyl group directly attached to an atom of unsaturated system

(b) electrons of carbon-hydrogen σ bond of alkyl group directly attached to the positively charged carbon atom

(c) #-electrons of carbon-carbon band

(d) lone pair of electrons

23. Among the following which st



(a) Conjugate trase of (1) is more stable than that of phenol (II). b) Conjugate base of (II) is more stable than that

of benzoic acid (I). ) Magnitude of positive charge on H atom of

-OH group is greater in (1) than (11). Magnitude of positive charge on H atom of OH group is greater in (II) than (I).

Numerical Value Type 24. An organic compound containing bromine gave the

following results on analysis: (i) 0.246 g of the compound gave 0.198 g of COand 0.1014 g of H-O on combustion.

(ii) By Carius method, 0.37 g of the compound gave 0.638 g of AgBr. The value of n of the compound, if its V.D. is 54.5, will be (n = Mol.wt/Empirical wt.)

25. The molecule CH<sub>3</sub>CH=CH-CH-CH<sub>3</sub> has 'X' stereoisomers and 'Y' stereogenic centers. The value

of X+Y is 26. How many alkenes, from followings are more stable

Comprehension Type

The experimental analysis of a hydrocarbon A(CaHa) says that it exists in three stereoisomeric forms, of

Codes

(a) 2.5

which one is ontically active (B) while the other two are optically inactive (C and D). All the three forms of (A) absorbs two moles of H- to produce E (CaH-a) which is optically inactive. All the three forms of (A) have the same length of carbon chain and position of multiple bonds. None of the forms of (A) neither gives white precipitate with ammoniacal AgNO, nor reacts with H,

in presence of Pd-BaSO<sub>a</sub>/quinoline. 27. What could be the structure of (A), if it is optically active and exists only in one form?

(c) H,C-

(d) None of these.

28. The isomer of (C) which is also optically inactive is

Matrix Match Typ 29. Match the column I with column II and choose the correct option using the codes given below:

correct option using the codes given below: Column II

CH-CH-

(d) 1,2 Keys are published in this issue. Search new! O

# CHECK YOUR PERFORMANCE

If your score is No. of questions attempted > 80% Your preparation is going good, keep it up to get high score. No of questions correct

Column II

60-80% Need more practice, try hard to score more next time. Marks scored in percentage Stress more on concepts and revise thoroughly.



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# UNIT - 8: Polymers | Chemistry in Everyday Life

# POLYMERS

- · Polymers are macromolecules having high molecular mass (103 - 107 u) and are formed by joining of repeating structural units called monomers on a large scale.
- · This process of formation of polymers from respective monemers is called polymerication.
- The polymer may be a long chain or joined in two dimensions forming a sheet.

### Types of POLYMERS

- · Homopolymers : Polymers made up of only one type of monomer. e.g., polythene, PVC etc. nCH<sub>2</sub> = CH<sub>2</sub> Polymerisation + CH<sub>2</sub> - CH<sub>2</sub> - CH<sub>2</sub>
- · Copolymers : Polymers made up of two or more types of menomers, e.g., buna-S, nylen 6, 6, etc. The process of formation of copolymer is called
  - cepolymerisation nNH<sub>2</sub>(CH<sub>2</sub>),NH<sub>2</sub> + nHOOC(CH<sub>2</sub>)<sub>4</sub>COOH Affinic acid
- +N-(CH<sub>2</sub>)4-N-C-(CH<sub>2</sub>)4-C±

### Nyloz 6, 6 Types of Polymerisation Reactions

## Addition (Chain-growth) polymerisation Mechanism of free radical addition polymerisation:

- This is initiated by organic peroxides or by light. Steps involved are:
- Chain initiation : Peroxide heat R/Radical

- Chain propagation: R - CH, -CH, -CH, CH.-CH.+CH. CH.->
  - R-CH,-CH,-CH,-CH, R- CH<sub>2</sub>- CH<sub>2</sub>- CH<sub>3</sub> - CH<sub>3</sub> → → →
- R (CH, CH, + CH, CH, - Chain termination : By combination
- 2R (CH2 CH2), CH2 CH2 → R (CH,CH,+CH,-CH,-CH,-CH,(CH,CH,+R or by disproportionation
  - 2R (CH2 CH2), CH2 CH2 → R4CH-CH-CH-CH-

e.g., polythene, polystyrene. Mechanism of cationic addition polymerisation : Initiated by the use of strong Lewis acids such as HE AICL, H-SO, etc.

with several monomers and finally the chain is

terminated by combination with a negative ion or loss of a proton, e.g., polyvinyl ether,

- H-SO4 -+ H+ HSO4 H\* + CH,=CH, -> CH, - CH;
- Carbocation - Carbocation formed will undergo addition

polyisobutylene, polystyrene, etc.

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istermolecular feece

 Mechanism of anionic addition polymerisation: Initiated by strong bases such as NaNH, C.H.Li and Grignard reagent, etc.

# BE+CH, =CH, →B-CH,-CH.

- The so formed carbanien undergoes addition with number of monomers and finally terminates.
- This mechanism is more favourable when the monomer alkene have electron withdrawing group to stabilize the intermediate carbanion.

# CLASSIFICATION OF POLYMERS Neither very strong nor very weak Do not have any cross-links between

Thermoplastics:

intermolecular foces.

Elastomers : Very weak intermolecular forces and possess elastic characters, e.g., natural rubber, buno-5, etc.

ddition polymers

formed by addition

of processes without

dimination of by-

products e.g., PVC.

solubere, etc.

polypeopylene, polystyrene, etc. Linear polymers : Monomers are joined together to form straight chains. e.g., PVC, polystyrene,

nylons, etc. Branched chain polymers : Monemers are oined to form Monemers are jumes having irregularly packed polymers having branched chains. e.g., amylopectin,

Can be easily moulded on heating e.g.

glycogen, starch, etc. Cross linked polymers : Initially formed linear polymer chains are icined together to form a three dimensional network structure e.g. bakelite, melamine formaldelsyde

### resin (melmac), etc. RUBBER

- Natural rubber . It is a linear 1, 4-addition polymer of isoprene and
- have eis-configuration of all double bonds thus. known as cis-1, 4-polyisoprene. . It is insoluble in water, dilute acids and alkalies but soluble in organic solvents like benzene, petrol etc.
  - It has low elasticity and tensile strength. It has weak intermolecular van der Waals' forces - Its natural trans-isomer is gutta-percha which
- is non-elastic.

### Vulcanisation of rubber

· It is the process of heating natural rubber with sulphur at a temperature of 373-415 K.

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e.e., polymerisation of acrylonitrile and methyl methacrylate, etc.

### Condensation (Step growth) polymerisation . These are formed by the condensation of two

- or more bifunctional monomer units with the elimination of simple molecules like H-O. NH-1. CO. etc.
  - The product of each step still contain two functions groups. Thus, the process proceeds by stepwise intermelecular condensation, e.g., formation of nylon, terylene and bakelite, etc.

cress-links are

like hudrogen bends formed between polymeric ag, mico-6, 6, polyacrychains on heating and they knitrile (orien), ck. undergo permanent change. seg., bakelite, resin, etc. Natural polymers : Substances of natural origin, i.e., found mainly in plants and animals.

e.g., sik, enzymes, natural rubber, haemeglobin, starch, cellulose, proteins, etc. Semi-synthetic polymers:

Derived by using natural polymers e.g. vulcanised rubber, nitrecellulose, cellulese Condensation polymers: xanthate, etc. Fermed by combination of menomers with Synthetic polymers : Porrared elimination of simple in laboratory or completely molecules like water, man-made polymers e.g. alcohol, ammonia, etc. itefion, dacron, synthetic rubber,

- nylon-6,6, etc - Sulphur cross-links makes the rubber hard, tough with greater tensile strength
- Some additives like carbon black, zinc oxide etc. are used to improve wearing properties.

### Synthetic rubber It is obtained by polymerising certain organic

e.g. dacron, rylon-6,6, etc.

compounds which may have properties similar to rubber and some additional desirable properties. Most of these polymers are derived from butadiene derivatives. These are also vulcanised. For example, neoprene, styrene butadiene rubber (SBR), thiokol, silicones, polyurethane rubber.

### POLYETHYLENE

# - Addition or chain growth homopolymer.

- By heating ethylene under high pressure (1000-2000 atm) at temperature of 350-570 K in presence of traces of oxygen or peroxide.
- Free radical addition polymerisation. - Highly branched polymer.
- Low density (0.92 g/cm3), low melting point (384 K)
- Transparent, moderate tensile strength. - Chemically inert, tough but flexible.
- Used for packaging, insulation and manufacturing
  - squeeze bottles, pipes, toys, etc.
- Linear addition or chain growth homor - By heating ethylene at 333-343 K and 6-7 atm i of Ziegler-Natta catalyst.
- Coordination polymerisation - Linear molecules, closely packed.

and pipes, etc.

- High density (0.97 g/cm3), high melting point (403 K).
- Translucent - Chemically inert, quite harder, greater tensile strength. - Used for manufacturing containers, housewares

### SOME IMPORTANT POLYMERS

Polymer	Structure of monomer	Structure of polymer	Uses As insulator, packing material, household and laboratory ware.		
Polythene	CH <sub>2</sub> =CH <sub>2</sub>	+ChiChi_+			
Polyvinyl chloride (PVC)	CH <sub>2</sub> =CHCI	fcH₂-cH a	In manufacture of raincoats, hand bags, leather clothes and vinyl flooring.		
Polytetrafluoro - ethylene (PTFE) or Teflon	Cf₂=Cf₂	+CF2-CF2+;	As lubricant, insulator and making cooking wares.		
Polyacrylenitrile (PAN) er Orlen	CH <sub>2</sub> =CH−CN	CH <sub>2</sub> -CH CN ,	In making synthetic fibres and wool.		
Styrene Butadiene Rubber (SBR) or (Bona-S)	CH=CH <sub>2</sub> and  CH <sub>2</sub> =CH-CH=CH <sub>2</sub>	CH2-CH-CH2-CH=CH-CH3	In making automobile tyres, floor tiles, cable insulation and footwear.		
Nitrile rubber (Buna-N)	CH <sub>2</sub> =CHCN and CH <sub>2</sub> =CH-CH=CH <sub>2</sub>	[CH-CH <sub>2</sub> -CH <sub>2</sub> -CH=CH-CH <sub>2</sub> ]	In making oil seals, hose-pipes and tank linings.		
Nylon-6 (Perlon-L)	H <sub>o</sub>	G-(CH <sub>2</sub> ) <sub>5</sub> -N O H	In making carpets, ropes and tyre cords.		

Nylen-6, 6	HOOC-(CH <sub>2</sub> ) <sub>4</sub> -COOH and H <sub>2</sub> N-(CH <sub>2</sub> ) <sub>4</sub> -NH <sub>2</sub>	+CO-(CH <sub>2</sub> ) <sub>4</sub> -CONH-(CH <sub>2</sub> ) <sub>6</sub> -NH+	Synthetic fibres, fishing nets, and tyre industries.
Terylene (Dacron)	HOOC-O-COOH and HOCH <sub>2</sub> CH <sub>2</sub> OH	-O-CH2-CH2-O-C	Synthetic fibres, safety belts, tyre cords and tents.
Bakelite (Phenol- formaldehyde resin)	OH and HCHO	OH OH CH2	In making gears, protective coatings and electric fittings.

# MOLECULAR MASS OF POLYMERS Number average molecular mass, M

- Weight average molecular mass, The ratio of weight average molecular mass to number average molecular mass is called
- · Natural fibres usually have PDI equal to 1 while synthetic fibres usually have PDI > 1. Biopolymers disintegrate by enzymatic hydrolysis

# polydispersity index (PDI). BIODEGRADABLE POLYMERS biodegradable.

CHEMICALS IN MEDICINES

and to some extent by exidation and hence are

 Drugs are the chemicals of low molecular masses (~ 100-500 u) which interact with macromolecular Synthetic polymers are non-biodegradable and hence create disposal problem. To overcome this, biodegradable synthetic polymers have been developed. -fl-hydroxybutyrate - ce-fl-hydroxy-- Pely

valerate (PHBV): It is a copolymer of 3-hydroxybutanoic acid and 3-hydroxypentanoic acid. Used in speciality packaging, orthopaedic devices and in controlled drug release. Pely (plycolic acid) and Poly (lactic acid)

or Dextron : A copolymer of PGA and PLA (90 : 10) was the first biodegradable polyester used for stitching of wounds. Nylon-2-Nylon-6 is a step-growth polyamide copolymer of glycine and e-aminocaproic acid.

### CHEMISTRY IN EVERYDAY LIFE

targets and produce a therapeutic and useful

biological response. These chemicals are called medicines. Use of chemicals for therapeutic effect is called chemotherapy.

# Classification of Drugs

· Drugs are classified on the basis of

. It is based on the action of a drug on a particular biochemical process. Antibistamines Chemical structure . It is based on the chemical structure of

the drog. Sulphonamides Pharmacological effect

 Analgesics (pain killer) · Antisentics (kill or arrest the growth of microorganisms)

 Antipyretics (reduce fever) Molecular targets

. It is based on the interaction with biomolecules such as carbohydrates. lipids, proteins and nucleic acids.



DRUGS

### Drug Target Interaction

- Enzymes as drug target: Drugs inhibit any of the two activities of the enzymes, they can block the binding site of the enzyme and prevent the binding of substrate or they can inhibit the catalytic activity of enzyme.
- Receptors as drug target: Preteins which transmit communication to the different parts of the body are called receptors. Receptor proteins are embedded in the cell membrane and it changes its shape to accommedate a chemical messenger which brings about transfer of message into the cell.

# Drug interact with receptors in two ways:

- Drugs bind to their receptor sites and inhibit its natural function (antagonists). These are useful when blocking of message is required.
   Some drugs mimic the natural messenger by
- switching on the receptor (agenists). These are useful when there is lack of natural chemical messenger.

### Therapeutic action of different classes of

### Antacids: These are chemicals which neutralise excess in the gastric juice and give relief from acid

- indigestion, acidity, heart burns and gastric utcers, e.g., magnesium hydroxide, calcium carbonate; etc.

  • Antihistamines: They diminish or alcohol the main action of histamine released in the body and hence, prevent aleroic reactions, e.g., discherollydramine
- prevent allergic reactions e.g., diphenylhydramine (benadys), phenaturine maleate (avii), etc.

  Tranquilizers? These are chemical substances used for the treatment of stress, mild and severe mental diseases. They are neurologically active drugs e.g.,
- veronal, arrytal, seconal, equanil, chlordiazepexide, etc.

  Analgesics: These are chemical substances which
- reduce pain. They are classified as:

  Non-narcotic analgesics: Aspirin and paracetamol belong to this class of drugs. They
  - are effective in relieving skeletal pain such as due to arthritis.
  - Narcotic analgesics: These are mainly used for the relief of post operative pain, cardiac pains and pains of terminal cancer.

- Antimicrobials: These are chemical substances used to cure infections due to microorganisms, e.g., sulphadiazine, sulphadoxine, etc. Antibiotics, antiseptics and disinfectants are antimicrobial drues.
- Antibiotics: The antibiotics may be either bacteriocidal (kill the organisms in the budy)
   e.g., penicillin, oflexacin, etc., or bacteriostatic (inhibit the growth of creanisms), e.g.,
  - erythromycin, chloramphenicol, etc.

    Antiseptics: These are chemicals which either kill or prevent the growth of microorganisms
  - and are applied to the living tissues such as wounds, cuts, ulcers and diseased skin. Dettel is a commonly used antiseptic.

    Disinfectants: These are also used to kill
- macroorganisms, but they are applied to inanimate objects.

  Some substances can act as antiseptic as well as
- disinfectant by varying the concentration.

  Antifertility drugs: Chemical substances used
  - to prevent conception or fertilization are called antifertility drugs. e.g., milepristone, ormeloxifene, etc.

# CHEMICAL IN FOOD

Alitame

- Chemicals which are added to food for their preservation or enhancing their appeal, flavour, etc. are known as food additives.
- Food preservatives: These are the chemical substances which are added to the food materials to prevent their spoilage and to retain their nutritive value for long periods.
   These preservatives prevent the rancidity of food
- and inhibit the growth or kill the microorganisms.

  The most common preservative used is sodium benzoate (C<sub>0</sub>H<sub>2</sub>COCNa).

  Artificial sweetening agents: These are chemical compounds which give sweetening effect to the

Artificial Sweetener	Sweetness Value in Comparison to Cane Sugar
Aspartame	100
Saccharin	550
Sucralose	600

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 Antioxidants: These are the chemical substances which prevent oxidation and subsequent spoilage of the food by retardine the action of oxygen on food. They act as sacrificial materials as they are more reactive towards oxygen than the materials they are protecting.

### CLEANSING AGENTS

- · Soaps: These are sodium or potassium salts of higher fatty acids (with 12-18 carbon atoms) e.g., salts of C15H31COOH (palmitic acid), C12H14COOH (stearic acid), C12H14COOH (oleic acid), C17H11COOH (linoleic acid), etc.
- Soapless soaps or synthetic detergents: These are sodium salts of long chain alkyl hydrogen sulphates or the sodium salts of long chain benzene sulphonic
  - acids - Cationic detergents : These are quaternary ammonium salts of amines with acetates or halides as anions. e.g.,
  - trimethylstearylammonium chloride, CH<sub>2</sub>(CH<sub>2</sub>)<sub>12</sub>N\* (CH<sub>2</sub>)<sub>2</sub>CF
  - Anionic detergents : These centain an hydrophilic groups e.g., sodium lauryl sulphate C.-H.,OSO, Na

Non-ionic detergents: These are esters of high molecular mass and do not contain ions e.g. polyethylene glycol stearate, CH<sub>2</sub>(CH<sub>2</sub>)<sub>2</sub>COO(CH<sub>2</sub>CH<sub>2</sub>O), CH<sub>2</sub>CH<sub>2</sub>OH

# Cleansing Action of Soaps and Detergents

structure called micelles.

- · The hydrophilic carboxylate group interact with water molecules while the hydrophobic long non-pelar hydrocarbon chain does not interact. The hydrocarbon chains cluster together forming
  - In the micelles, the carboxylate groups form a negatively-charged spherical surface, with the hydrocarbon chains inside the sphere
- Being negatively charged, soap micelles repel each other and remain dispersed in water



# RACTICE

the following steps are involved

s should be in sequence of

2. Which of the following substances is not an organophosphorus insecticide? (a) Malathion (b) Parathion

(c) Phosdrin (d) Retenone

(b) IL L III

(4) 1 111 11

1. For the preparation of a detergent of from benzene, 3. The copolymer formed by addition polymerization of styrene and acrylonitrile in the presence of peroxide

(a) 
$$-CH_2 - CH_2 - CH - CH_2 - CH_2$$

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(a) 1. II. III

(c) II III I

(IEE Main 2018) 4. Which of the following is an example of liquid dish

CH,CH,CH

washing detergent?

OH HCHO (Small amount) (OH1)

- (c) bakelite (d) novolac
- nevelac 6. On complete hydrogena
- (a) ethylene-propylene copolymer
- (b) vulcanised rubber (c) polypropylene
- (d) pelybutylene (JEE Advanced 2016) 7. Which of the following statements is not true? (a) The colour of a dye is the colour of the light it

nevelad

bakelite

reflects. (b) The colour of a dye is the colour of the light it

### absorbs. (c) Blue is the complimentary colour of yellow.

- (d) -CO<sub>3</sub>H is an auxochrome.
- 8. Which is a polymer of three different monomers? (a) ABS (b) SBR (c) NBR (d) Nylon-2-nylon-6
- 9. Which one of the following pairs is not correctly matched?

- (a) Teflon: Thermally stable cross linked polymer of phenol and formaldehyde (b) Synthetic rubber: A copolymer of butadiene
- and styrene (c) Terviene: Condensation polymer of terephthalic acid and ethylene glycol
  - (d) Perspex: A homopolymer of methyl methaczylate
- 10. Natural rubber has (a) alternate cis- and trans-configuration (b) random cis- and trans-configuration
- (c) all cis-configuration (d) all trans-configuration. (NEET Phase-I 2016) CH
- CHyCOCL PY KMnO4
  - The final product 'Y' is a medicine. Which of the following is incorrect regarding "Y" (a) It has analgesic as well as antipyretic properties.
  - (b) It helps to prevent heart attack. (c) It has anti-blood clotting action. (d) It suppresses the gastric anomalies.
  - Which of the following is used in vulcanization of
  - (b) CF4 (c) ClsF, (d) CsF, When melamine and formaldehyde polymerise, a
  - resin intermediate is formed. Identify the structure of this intermediate.
  - H<sub>2</sub>N NH<sub>2</sub>
  - NHCH,
  - NH,
    - HOH,C
  - CH-OH 14. Which of the following is a biodegradable polymer?

NHCH,OH

(a) +HN = (CH<sub>2</sub>),NHCO = (CH<sub>2</sub>), = C

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# ome Basic Concepts of Chemistry

- Number of gram atoms = Mass of an element
- Atomic mass = 6.4/Specific heat (cal/g)
- Mass per cent (%) =  $\frac{W_{solute}}{W_{solution}} \times 100$
- Mole fraction  $(x_A) = \frac{n_A}{n_A + n_B}, (x_B) = \frac{n_B}{n_A + n_B}$
- Molarity (M) =  $\frac{w_2 \times 1000}{M_2 \times V(\text{in mL})}$
- Molality (m) =  $\frac{w_2 \times 1000}{M_2 \times w_1(\text{in g})}$

- Structure of Atom •  $E = hv = \frac{hc}{\lambda}$ ;  $\frac{1}{\lambda} = \overline{v} = R\left(\frac{1}{n^2} - \frac{1}{n^2}\right) cm^{-1}$ ;

- $mvr = \frac{nh}{2\pi}$ ;  $\Delta x \cdot \Delta p \ge \frac{h}{4\pi}$
- $r_n = \frac{n^2}{2} \times 0.529 \text{ Å}; E_n = \frac{-Z^2}{2} \times 13.6 \text{ eV/aton}$
- $v_{-} = \frac{Z}{2} \times 2.188 \times 10^{8} \text{ cm/s}$
- K.E. =  $\frac{1}{2} \frac{kZe^2}{R}$ ; P.E. =  $-kZe^2$

### Thermodynamics ∆U=a+w

- $w_{trr} = -P\Delta V$
- $w_{rev} = -2.303nRT \log \frac{V_2}{V} = -2.303nRT \log \frac{P_1}{P}$
- $\Delta H = \Delta E + \Delta n_{\mathbf{g}}RT$ ;  $C_{\nu} = \left(\frac{\partial E}{\partial T}\right)_{\nu}$ ;  $C_{p} = \left(\frac{\partial H}{\partial T}\right)_{p}$  $\bullet \log \frac{P_2}{P_1} = \frac{\Delta H_{vap}}{2.303R} \left( \frac{T_2 - T_1}{T.T_2} \right)$
- $\Delta S = 2.303 nR \log \left(\frac{V_2}{V_2}\right)$ ;  $\Delta G = \Delta H T\Delta S$ •  $\Delta G^o = -2.303 RT \log K$ ,  $\Delta G^o = -nFE^o_{cell}$

### States of Matter

- $P_1V_1 = P_2V_2$ ;  $\frac{V_1}{T} = \frac{V_2}{T}$ ;  $\frac{P_1}{T} = \frac{P_2}{T}$ ;  $\frac{V_1}{T} = \frac{V_2}{T}$ ;  $\frac{V_1}{T} = \frac{V_2}{T}$ ;  $\frac{V_1}{T} = \frac{V_2}{T}$ ;  $\frac{V_2}{T} = \frac{V_2}{T}$ ;  $\frac{V_3}{T} = \frac{V_3}{T}$ ;
- $d = \frac{PM}{RT}$ ;  $\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M}} = \sqrt{\frac{d_2}{d}} = \frac{v_1 d_2}{v_2 d_2}$ ,  $K E = \frac{3}{2}kT$
- $c_{max} = \sqrt{3RT/M}$ ;  $c_{max} = \sqrt{2RT/M}(c_{max} = \sqrt{8RT/\pi M})$   $T_b = a/Rb$ ;  $T_c = 8a/27Rb$ ;  $P_c = a/27b^2$ ;  $V_c = 3b$
- $Z = \frac{PV_m}{-RT}$ ;  $P_sV_s = \frac{3}{2}RT_s$ ;  $P + \frac{n^2a}{3r^2}$  (V nb) = nRT

# For a reaction, aA + bB ⇒ cC + dD

- $K = \frac{|C|^{c}|D|^{d}}{|A|^{d}|B|^{b}}; K_{p} = \frac{p_{C}^{c}p_{D}^{d}}{n^{d}n^{b}}; K_{p} = K_{e}(RT)^{An}$
- $\log \frac{K_2}{K_1} = \frac{\Delta H}{2.303R} \left( \frac{T_2 T_1}{T_1 T_2} \right)$ :  $K = \frac{C\alpha^2}{1 \alpha} = C\alpha^2$
- $pH = \frac{1}{2}[pK_w pK_h \log C]$  (for salts of strong acid and weak base)
- $pH = \frac{1}{2}[pK_{-} + pK_{-} pK_{+}]$  (for salts of weak acid and weak base)
- pH = \( \frac{1}{2} [pK\_w + pK\_o + \log C] \) (for salts of weak acid and strong base)

# Hydrocarbons

- . Conformations of ethane: Staggered > Skew or Gauche > Eclipsed Conformations of cyclohexane: Chair > Twist-boat > Boat > Half-Stability order of different alkenes:
- $R_2C = CR_2 > R_2C = CHR > R_2C = CH_2 >$  $C = C \xrightarrow{H} \xrightarrow{R} C = C \xrightarrow{R} \Rightarrow RCH = CH_2 \Rightarrow CH_2 = CH_2$
- Acidity: Alkynes > alkenes > alkanes (as s-character ≪ acidity). Alkynes undergo electrophilic and nucleophilic addition reactions · Aromatic compounds : Cyclic, completely conjugated system of
- p-orbitals in ring, planar,  $(4n + 2)\pi e$ 's Anti-aromatic compounds: Cyclic, completely conjugated system of
- p-orbitals in ring, planar, 4n n-e's. . Non-aromatic compounds: Does not satisfy any one or more of the



### Type of No. of hybrid Shape of molecule hybridisation orbitals Linear Trigonal planar Tetrahedral Square planar dip3 or m3d Trigonal bipyram sp3 or sp3d2 Octabedral

**Chemical Bonding** 

d'sp' or sp'd'

Pentagonal biovram

Organic Chemistry

Some Basic Principles and Techniques · Preference order of functional groups: Carboxylic acids > sulphonic acids > anhydrides > esters > acid chlorides > acid amides > nitriles

> isocyanides > aldehydes > ketones > alcohols > phenols > thiols > amines > alkenes > alkynes

· Stability order: Carbocations: 3° > 2° > 1° > CH<sub>2</sub>: Carbanions: CH<sub>2</sub> > 1° > 2° > 3°

Free radicals: 3° > 2° > 1° > CH, -I effect: -NO<sub>3</sub>>-CN>-COOH>-F>-CI>-Br>-I>

+I effect: (CH<sub>3</sub>)<sub>3</sub>C -> (CH<sub>3</sub>)<sub>2</sub>CH -> CH<sub>3</sub>CH<sub>2</sub> -> CH<sub>3</sub> -> D ->

• +R effect : - OH, - OR, -SH, - SR, - NH<sub>2</sub>, - NHR, - NR<sub>3</sub> \_CL\_R-T

-R effect: C=0. - CHO. - COOR. - CN.

• Stability: Li-CO<sub>2</sub> < Na<sub>2</sub>CO<sub>2</sub> < K<sub>2</sub>CO<sub>2</sub> < Rb<sub>2</sub>CO<sub>3</sub> < Ca<sub>2</sub>CO<sub>3</sub>

Bond angle

//www.pdfbasket.com d p-Block Ele Basic strength: LIOH & NaOH & KOH & RhOH & CAOH Be(OH)<sub>2</sub> < Mg(OH)<sub>2</sub> < Ca(OH)<sub>2</sub> < Sr(OH)<sub>2</sub>

> - BeCO<sub>4</sub> < MgCO<sub>4</sub> < CaCO<sub>4</sub> < SrCO<sub>4</sub> < BaCO<sub>4</sub> - BeSO4 < MgSO4 < CaSO4 < SrSO4 < BaSO4 Solubility: BeCO<sub>1</sub> > MgCO<sub>2</sub> > CaCO<sub>3</sub> > SrCO<sub>3</sub>

B(OH)<sub>3</sub> < Al(OH)<sub>3</sub> < Ga(OH)<sub>3</sub> < In(OH)<sub>3</sub>

< Ba(OH)

< TI(OH).

-×100

V 100

×100

Wt, of AgX formed

Wt. of compound

> BaCO.

- BeSO4 > MgSO4 > CaSO4 > SrSO4 > BaSO4

Stability of oxidation states : B3+ > Al3+ > Ga3+ > In3+ > Tl3+ ; B+ < Al+ < Ga+ <  $\ln^{+} < \Pi^{+} : Ge^{4+} > Sn^{4+} > Ph^{4+} : Ge^{2+} < Sn^{2+} < Ph^{2+}$ 

Lewis acid character:  $BX_3 > AlX_3 > GaX_3 > InX_3$ ;  $BF_3 < BCl_3 < BBr_3 < BI_3$ Catenation tendency : C >> Si > Ge ≈ Sn >> Pb Acidic strength: Acidic strength of their oxides

decreases down the group.

# **Quantitative Estimation**

· Liebig's combustion method : Mass of CO, formed % of C = 12 x --×100 44 Mass of compound taken % of H = 2 ×-Mass of H.O formed 18 Mass of compound taken

Dumas' method: 28 Vol. of N2 at STP

% of N =  $\frac{28}{22400} \times \frac{\text{Vol. 0.1.2}}{\text{Wt. of compound}}$ 

Kieldahl's method: % of N =  $\frac{1.4 \times M_{acid} \times V_{acid} \times Basicity}{}$  of N =  $\frac{1.4 \times M_{acid} \times V_{acid}}{}$ 

· Carius method:

At. wt. of X

108 + At. wt. of X 32 Wt. of BaSO<sub>4</sub> formed

% of  $S = \frac{32}{233} \times \frac{Wt. of compound}{Wt. of compound}$ 

Ignition method: Wt. of Mg<sub>2</sub>P<sub>2</sub>O<sub>7</sub> formed

 $\% \text{ of } P = \frac{62}{222} \times \frac{Wt}{}$ Wt. of compound

Iodine method:

32 Wt. of CO, formed % of O = 32 v. ×100 88 Wt. of compound



- 15. Polyvinyl alcohol can be prepared by (a) polymerization of vinyl alcohol
  - (b) alkaline hydrolysis of polyvinyl acetate
  - (c) polymerization of acetylene (d) reaction of acetylene with H-SO, in presence of
- HeSO. (IEE Main 2017) 16. Suppose 30% molecules have M = 20000; 40%
- molecules have M = 30000, rest of them have M = 60000. Calculate PD1 (a) 1.45 (b) 1.20
- (d) 0.98 17. Amexicillin is semi-synthetic medification of
- (a) penicillin (b) streptomycin (c) tetracycline (d) chloramphenicol.
- 18. What is the similarity between buna-N and PHBV (a) Both are copolymers.
  - (b) Both are biodegradable
  - (c) Both have one same monor (d) Peroxide catalyst is used in their preparat
- 19. Mixture of chloroxylenel and terpi (a) antisentic
  - (c) antibiotic NEET 2017)
- 20. Which of the following polymer can be formed by using the
- following monemer un (a) Nylon-6, 6
- (b) Nylon-2-nylon ĊH-(c) Melamine poly
- (d) Nylon-6 21: Which of the fellowing can possibly be used as analgesics without causing addiction and any
  - medification? (a) Morphine
  - (b) N-acetyl-ours-aminophenol (c) Diazepam
- (d) Tetrahydrocannabinol 22. During the vinvl polymerisation, the chain transfer
- agent is

- (a) CCL (b) C.H.OH (c) 1-butyl peroxide (d) diphenylamine.
- 23. Which one of the following structures represents
  - nylon 6, 6 polymer?

(NEET Phase-I 2016) 24. Pheromones are chemicals (a) formed by fermentation process of funei (b) secreted by endocrine glands of man

- (c) secreted outside the body of insects (d) plant growth hormones. 25. Which of the following are correct about cimetidine
  - and ranitidine? I. These are antihistamine drugs.
  - II. Both prevent the interaction between histamine and receptor of stomach wall.
  - III. These prevent the excess production of hydrochloric acid.
  - (b) 1. II and III (c) II and III (d) I and III
  - CH CH
  - HF, Friedel-Crafts R-CH-CH, R - CH - CH.

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- 2. (d) 3. (d)
- 4. (b): Non-ionic detergents are used as liquid dish washing detergents.
- 5. (b) 6. (a) 7. (b)
- 8. (a): ABS is acrylonitrile-butadiene-styrene rubber which is obtained by copolymerisation of
- acrylonitrile, 1, 3-butadiene and styrene.  $CH_2 = CH + CH_2 = CH$ + CH<sub>2</sub>= CHC<sub>4</sub>H<sub>4</sub> -CH=CH.
  - Acrylenitrile 1,3-butadiene CH\_CH\_CH\_CH=CHCH\_CH\_CH\_
  - ABS 9. (a): Teflon is a thermally stable polymer of tetrafluore ethylene (CF2 = CF2).
    - H.CE, = CE, Polymerisation F,C-CE,
  - 10. (c) OCOCH,
  - 12. (a) H-N 13. (c): NHCH,OH
  - 14. (b): NH CH-CONH (CH-)- C
- Nylon-2-oylon-6 CHEMISTRY TODAY | FERRUSE '14

- It is a polymer of glycine and aminocaproic acid and is a biodegradable polymer.
- 15. (b)
- 16. (b); PDI=

- 30×20000+40×30000+30×600 30+40+3 6×105+12×105+18×10

  - - ¥10<sup>20</sup> +10.8×10<sup>20</sup>

    - 36×36×10<sup>8</sup> =1.20 36×10<sup>5</sup>/36×10<sup>3</sup> 19. (a) (d): The monomer is caprolactam and hence the
- polymer is nylon-6. 21. (b)
- 22. (a): During the vinvl polymerisation, the chain transfer agent is carbon tetrachloride (CCL). 23. (d): Nylon 6.6 is obtained by condensing adipic acid (HOOC-(CH3)4-COOH) with hexamethylenediamine (H<sub>2</sub>N-(CH<sub>3</sub>)<sub>4</sub>-NH<sub>3</sub>).

25. (6) 26. (4) 27. (c)

30. (d)

OCH,

COOH

25. (b): Cimetidine and ranitidine are antihistamine drugs. It prevent the interaction of histamine with the receptors present in the stemach wall. This results in release of lesser amount of acid.

MO	NTHLY	TUN	E UP CL	ASS	XI	AN	SWER	K	EΥ
ı.	(b)	2.	(c)	3.	(d)	4.	(c)	5.	(a)
6.	(b)	7.	(a)	8.	(b)	9.	(c)	10.	(a)
11.		12.		13.	(a)	14.	(a)	15.	(c)
16.	(b)	17.	(c)	18.	(b)	19.	(d)		
20.	(a,c,d)	21.	(a,c,d)	22.	(a,b)	23.	(a.c)	24.	(1)

29. (c)

# with exclusive and brain storming MCQs is and give you extra edge in your JEE prepara

1. Two weak acid solutions HAand HA2 each with the same concentration and having pK., values 3 and 5 are placed in contact with hydrogen electrode (1 atm, 25°C) and are interconnected through a salt bridge. The emf of the cell is

(a) 0.21 V (c) 0.018 V



- 3. A mixture of two inorganic salts give following chemical reactivity:
  - (i) Mixture on reaction with dilute H-SO, evolves a colourless and unpleasant gas which turns acidic dichromate paper green.

ii) Mixture on reaction with concentrated H-SO. gives reddish brown gas which does not produce orange red spots on starch paper. The mixture gives white precipitate with barium chloride solution which is soluble in

- dilute HCL (iv) The sodium carbonate extract of mixture responds to brown rines test.
- The mixture contains (a) SO2 and NO2 anions (b) S2 and NO2 anions (c) \$5 and NO5 anions (d) \$05° and Br anions.
- In the following sequence of reactions:  $(A) \xrightarrow{\text{NaNO}_2} (C) \longrightarrow -\text{ve Victor Meyer test}$ a +ve mustard oil test
  - $NaNO_2 \rightarrow (D) \longrightarrow Blue colour in Victor$
  - Meyer test (A) and (B) are respectively
  - CH, (a) H<sub>2</sub>C-C-NH<sub>2</sub>CH<sub>3</sub>-N-CH<sub>3</sub>
  - CH NH, H,C-

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(a) AB (b) A<sub>2</sub>B<sub>7</sub> (c) A<sub>2</sub>B<sub>3</sub> (d) none of these. 6. When K<sub>2</sub>CrO<sub>4</sub> is added to CuSO<sub>4</sub> solution, there

is formation of CuCrO<sub>4</sub> as well as CuCr<sub>2</sub>O<sub>5</sub>. Formation of CuCr<sub>2</sub>O<sub>7</sub> is due to (a) basic nature of CuSO<sub>4</sub> solution (b) acidic nature of CuSO<sub>4</sub> solution

(c) CuSO<sub>4</sub> oxidizes CrO<sub>4</sub><sup>2</sup> to Cr<sub>2</sub>O<sub>7</sub><sup>2</sup> (d) the typical property of CuSO<sub>4</sub>.

7. CH<sub>2</sub>=CH<sub>2</sub> Bacyer's reagent, A

(1) KMnO<sub>d</sub>/OH<sup>\*</sup>
(2) Hadadayia B

 $CH_3$   $A + B \xrightarrow{Polymer isatist} C (Polymer)$ Here 'C' is

(a) glyptal (b) dacron (c) nylon-6, 6 (d) nylon-6 8. A coupled reaction is takes place as follow

 $A + B \longrightarrow C + D$ ,  $\Delta G' = + x kJ$   $D + E \longrightarrow F$   $\Delta G' = - y kJ$ For the spontaneity of reaction :  $A + B + E \longrightarrow C + F$ ,

which of the following is correct?

(a) 2x = y(b) x < y(c) x > y(d)  $x = (y) \times T\Delta S$ 

9. If vs. anjexperimental fact that Cs\_CoCl<sub>d</sub> is an orange coloured but compound ONS1<sub>d</sub>)\_[CoCl<sub>d</sub> is yellow. The total paramagnetic moment of erange compound is found to be more than that of yellow compound. Then which of the fellowing is correct!
(a) Anion of erange compound in textahedral and that of yellow is square planar.

(b) Anion of orange compound is square planar and that of yellow is tetrahedral.
(c) Beth the anions are tetrahedral.
(d) Both the anions are square planar.

 2-phenyl-2-hexanol can be prepared by Grignard synthesis. The pair of compounds giving the desired product is

(a) Br and Phr CH<sub>3</sub>

(c) Ph and Ph CCH<sub>3</sub>

Se and Ph CCH<sub>3</sub>

11. Given is the graph between  $(a-x)^{-1}$  and time.  $\int_{0}^{\infty} A \frac{\partial - \tan^{-1} \partial h}{\partial x} \frac{\partial h}{\partial x}$ Hence, rate at the start of the reaction is

 $\begin{array}{c|c} & & & & \\ & & & & \\ \text{(a)} & & & & \\ & & & & \\ \text{(b)} & & & & \\ & & & & \\ \text{(c)} & & & & \\ & & & & \\ & & & & \\ \text{(c)} & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & &$ 

(a) 0.45°C

(c) 0.90°C

erange coloured but compound  $(NH_0)_2[CnCl_0]$  is yellow. The total paramagnetic moment of orange 13. 0.2 melal acid HX is 20% ionised in solution. compound is found to be more than that of yellow compound. Then which of the following is correct? solution is:

(b) -0.90°C

(d) \_0.45°C

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- 14. Calculate the surface area of a catalyst that adsorbs 103 cm3 of Ny (reduced of STP) per gram in order to form the monolayer. The effective area occupied by single N<sub>2</sub> molecule on the surface is  $1.62 \times 10^{-15}$  cm<sup>2</sup>. (a) 2520 × 105 cm2 (b) 435 x 105 m2
- (c) 3720 m<sup>2</sup> (d) 436 v 105 cm2 15. For 'invert sugar', the incorrect statement(s) is(are) (Given : specific rotations of (+)-sucrose, (+)-maltose, L-(-)-glucose and L-(+)-fructose in
- aqueous solution are +66°, +140°, -52° and +92°, respectively)
  - (I) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose (II) 'invert sugar' is an equimolar mixture of
  - D-(+)-glucose and D-(-)-fructose (III) specific rotation of 'invert sugar' is -20" (IV) on reaction with Br, water, 'invert sugar' forms
  - saccharic acid as one of the product. (a) II and III (b) I and II (d) L II and IV
- (c) I and IV
- 1. (b): Pt|H<sub>2</sub>(1 atm)|HA<sub>2</sub>||HA<sub>3</sub>|H<sub>3</sub>(1 atm)|Pt At anode Enge = Empe + 0.059 (pH) (: pH = -log[H\*]
  - At cathode Essart = Etrart = 0.059 (pHI)
  - We know,  $[H^+] = C\alpha = \sqrt{K_aC}$  $pH_1 = \frac{1}{2}pK_{a_1} - \frac{1}{2}logC : pH_2$
  - $E_{-n}^{o} = E_{uvu^{+}}^{o} + E_{u^{+}vu}^{o}$
  - (a): (i)  $SO_3^{2r} + H_2SO_4 \longrightarrow SO_{2(g)} + H_2O + SO_4^{2r}$ K,Cr,O, + H,SO, + 3SO, ---K-SO4 + Cr-(SO4) + H-O
    - + Ba2+ --- BaSO , 4 (white) (ii)  $4NO_3^2 + 2H_2SO_4 \longrightarrow 4NO_2^2 + O_3^2 + 2SO_4^3$ 
      - + 2H-O As reddish brown eas does not produce orange red spets on starch paper, it can not be Br., So the anion is NOT

- (iv) 2NO<sub>3</sub> + 3H<sub>2</sub>SO<sub>4</sub> + 6Fe<sup>2+</sup> → 6Fe<sup>3+</sup> + 2NO<sup>↑</sup> + 3SO2" + 4H,O Fe2+ + 5H<sub>2</sub>O + NO ---> [Fe(H<sub>2</sub>O)<sub>2</sub>NO]<sup>2</sup>
- (a): In new arrangement,
- So, formula is AB
  - (b): Due to acidic nat
  - CrO2- H\* 10rsO2 COOH
- (b): A = CH<sub>2</sub>-COOH

Any Co-Curricular Activities in School?

"Dramatics"

"Really? What did you do?"

"Acted like I understood











- (b): For a spontaneous reaction, ΔG<sup>n</sup> must be negative and it can be possible only in this case when x < y.</li>
- (a): In [CuCl<sub>4</sub>]<sup>2-</sup>, orange compound, there is one unpaired electron in d-orbital, therefore, its hybridisation is sp<sup>3</sup> whereas in [CuCl<sub>4</sub>]<sup>2-</sup>, yellow compound, unpaired electron jumps to 5s and thus dsp<sup>3</sup> hybridisation.

 (b): Since, the graph of t vs (a - x)<sup>-1</sup> is a straight line, it must be a second order reaction.

$$\therefore k = \frac{1}{t} \left[ \frac{1}{(a-x)} - \frac{1}{a} \right] \text{ or } \frac{1}{a-x} = kt + \frac{1}{a}$$

On comparing, slope  $k = \tan \theta = 0.5 \text{ mol}^{-1} \text{ L. min}^{-1}$ 

 $k = \tan \theta = 0.5 \text{ mol}^{-1} \text{ L min}^{-1}$ Intercept  $(OA) = \frac{1}{-} = 2 \text{ L mol}^{-1} \text{ or } a = 0.5 \text{ mol} b$ .

Rate =  $k(a)^2 = 0.5 \times (0.5)^2 = 0.125 \text{ mol } L^{-1} \text{ mi}$ 

OH, OH-Ph

(d) Depression in freezing point, ΔT<sub>f</sub> = i × K<sub>f</sub> × m van't Hoff factor, i = 1 - α + mα

where n = no. of ions produced by complete dissociation of 1 mole of HX.

 $HX \rightleftharpoons H^+ + X^- \Rightarrow n = 2$  $1 - 0.2 + 2 \times 0.2$ 

1...  $\Delta T_f = 1.2 \times 1.86 \times 0.2 = 0.45$ Hence, freezing point of solution ( $T_d$ ) = 0 = 0.45

= -0.45°C

 $= \frac{6.022 \times 10^{23} \times 10^3}{22400}$  molecules

= 2.69 × 10<sup>22</sup> molecules area occupied by a single molecules

Area occupied by a single molecules

= 1.62 × 10<sup>-8</sup>

∴ Area occupied by 2.69 × 10<sup>22</sup> melecules

- =  $(1.62 \times 10^{-15}) \times (2.69 \times 10^{22}) \text{ cm}^2$ =  $4.36 \times 10^{-7} \text{ cm}^2 = 436 \times 10^{-5} \text{ cm}^2$ 15. (c) : Invert sugar is prepared by acid catalyzed
  - hydrolysis of sucrose.

    C<sub>12</sub>H<sub>22</sub>O<sub>11</sub> + H<sub>2</sub>O  $\xrightarrow{\text{HG}}$  C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> + C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

Sucrose

D(s) Glacose D(-) Fructose

Invert segar

Specific rotation of invert sugar is  $(\alpha)_{ma} = 0.5 \times (+5.2) + 0.5 \times (-9.2) + 26 - 46 = -20^{\circ}$ . On reaction with Be<sub>3</sub> water, invert sugar forms purcous: a sid as one of the products. Br<sub>2</sub> water existing pluconic acid and fructose is not existed by it.

For the

SCIENTIST

Disordered crystals are promising for future

bittery technology
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CHEMISTRY TODAY | FERRILIPS "15



a queries and doubts related to this topic at editorigimts in. The queries will be entertained by the author

# Physisorotion or Physical Adsorption or van der Waals' be negative only at low or moderate temperature

# Adsorption Adsorbed molecules (of adsorbate) are held on the

surface of adsorbent by weak van der Waals' forces, e.g., adsorption of water vapours on silice act is a reversible general process with quite low enthalpy of adsorption of abour 20 to 40 kl mol<sup>2</sup>. Physisorption decreases by increasing temperature or by decreasing pressure. Multimolecular layers of adsorbent are formed. Chemical Adsorption or Chemisorption or Language.

Adsorbed molecules (of adsorbate) are held on the surface of adsorbent by strong forces of chemical nature e.g., adsorption of H<sub>2</sub> gas on Pd-surface. It is specific and irreversible in nature with adsorption consequence of 00 to 400 kt molecules in the consequence of 00 to 400 kt molecules.

### energy of 40 to 400 kJ mol<sup>-1</sup>. It increases with increase in temperature upto certain limit after which is decreases. Layer formed is monomolecular. Factors Affecting Adsorption of Gases or Solids

- O Nature of adsorbent and adsorbate: Easily liquefiable or sincling or coloured gases are easily adsorbed on porous matter through physisorpticm while permanent gases are easily chemisorbed on metal surfaces.
- O Surface area of solid adsorbent: Adsorption of a gas is directly proportional to the surface area of the adsorbent. Surface area of 1 g solid is called specific surface which can be increased by making it rough, vacoum cleaning, steam cleaning, etc.

ΔG = ΔH − TΔS, specially physisorption.

O For chemisorption, increase in temperature helps

- in achieving activation barrier and thereafter extent of adsorption decreases.
  - of adsorption decreases.

    Pressure: The extent of adsorption  $\frac{x}{-}$  for
  - physiospecien is proportional to  $p^{2dn}$ .  $\frac{1}{n}$  is the slope of the plot of  $\log \frac{x}{m}$  vs  $\log P$ . It is known as Freundlich
- adsorption isotherm, after the name of the person who studied it the first. Catalysis

# It is the phenomenon of action of catalyst. Autocatalysis: A product of reaction acts as catalyst.

- Autocatanysis: A product of reaction acts as catanyst.
   Induced catalysis: Occurrence of a reaction is
- catalysed by some other reaction.

  Homogeneous catalysis: Catalyst and reactant(s)
- are in the same physical state.
   Heterogeneous catalysis: The catalyst and the reactant(s) are in different physical states. This
- phenomenon is explained by adsorption theory.
  Shape selective catalysis: Activity of some catalysts depends upon pore (cavity) size, ε.g., ZSM-5 converts CH<sub>1</sub>OH to easoline.
- A catalyst can not start a reaction. It cannot change the energy of reaction. Even a small quantity of a catalyst is sufficient enough. The extent of chemisorption decides the activity of catalyst. The ability of a catalyst for the production of specific product is called selectivity.

"By R.C. Groner, having 45+ years of experience in teaching chemistry



Enzyme catalysis: Enzymes are proteinous biocatalysts. They work in lock and key system with specific

- nature. These have extremely high efficiency to catalyse reactions to 106 times. In some cases an extra non-protein part called coenzyme also joins the enzyme. Now, the enzyme
- is called appenzyme while after it is known combination as holoenzyme. O Enzymes having two binding sites are called
- allosteric enzymes. Colloidal state: This is the state of dispersed phase
- particles when their size is 1 1000 nm and cannot pass through animal membrane or parchment paper. Based on states of dispersed phase (DP) and dispersion medium (DM), colloids are of eight types. A gas-gas mixture is always a solution. Lyophilic colloids: These colloids are reversible.
- have high stability and work as stabilizers for lyophobic colloids. These have surface tension lower than dispersion medium but have viscosity higher than dispersion medium. These generally, do not show electrophoresis, e.g., starch sol, gelatin sol, etc. O Lyophobic colloids: These are irreversible colloid
- which need a small quantity of lyophilic celleid or electrolyte for stability. Their surface tension and viscosity are equal to that of dispersion medium, e.g., sulphur sol, As,S, sol, etc. O Macromolecular colloids: These are colloids of
- substances (DP) of high molecular masses, e.g., starch, rubber, etc. Multimolecular colloids: These colloids have
- aggregates of DP particles of less than 1 nm size, e.g., gold sol, sulphur sol, etc. O Micelles or Associated colloids : Some strong electrolytes at some higher concentration called
- as Critical Micelle Concentration (CMC) and a specific temperature called as Kraft temperature form colloids known as associated colloids or micelles.
  - CMC for soap is 10-4 to 10-3 mol L-1. One micelle

Preparation of Lyophilic Sols

O Condensation methods : These are chemical methods exidation, reduction, double decomposition, hydrolysis, excessive cooling, exchange of solvent, etc.

O Disintegration methods: These are Bredig's electro disintegration, mechanical disintegration method (colleidal mill method), peptisation etc.

Origin of charge on colloidal particles: Charge on colloidal particles may appear because of electron capture, frictional electrification, preferential adsorption of ions, etc.

O Examples of negative colloids : Albuminoids in blood, metal sulphides, metals, macromolecular colloids, etc....

 Examples of positive colloids: Metal hydroxides. proteins in acidic medium, etc.

O Purification of sols: Iens present in colloidal solutions can be removed by centrifugation.

ultracentrifuration, dialysis and electrodialysis. O Properties of colloidal solutions : Heterogeneous nature. Show osmotic pressure as the only colligative

property. Visibility of particles under Zsigmondy's ultramicroscope. Colour depends upon the wavelength of scattered light. Brownian movement. Tyndall effect (originally studied by Faraday) is shown when refractive indices of DM and DP differ much but the size of DP particles is not much smaller than wavelength of light. Movement under electric field (Electrophoresis), etc.,

Coagulation or Flocculation or Precipitation

- It can be achieved by : (a) Adding oppositely charged colloid
- (b) Prolonged electrophoresis or dialysis
- (c) Addition of suitable electrolyte which is governed by Hardy Schulze Rules:
- The ion of electrolyte having charge opposite to that of colloidal particle, coagulates it (ii) Higher the charge of the coagulating ion, higher is
- its coagulation power (iii) Coasulation power of ion is directly proportional to the 6th power of the charge. The order of flocculating powers of some ions are:
  - For Fe(OH), positive sol: [Fe(CN),14" > PO?" > SO?" > CI" For As<sub>2</sub>S<sub>5</sub> negative sol : Sn<sup>4+</sup> > Al<sup>3+</sup> > Ca<sup>2+</sup> > Na<sup>+</sup> The minimum amount of electrolyte in millimole per litre of mixed solution needed to coasulate a colloidal solution is called the coagulation value of the electrolyte for the sol. Lower the coagulation

value greater is the coagulating power.

of soan has 100 or more R-C-O ions.

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### **Emulsions**

This colloidal solution is obtained by shaking two partly miscible or immiscible liquids.

Oil in water (O/W) type : Water is DM. It is

generally unstable.

O Water in oil (W/O) type : Oil is DM.

Dispersed phase of emulsion is generally negatively changed. Emulsion can be diluted, by the DM. Gunns, proteins, soaps etc., are used as emulsifiers for O/W type emulsions, metal salts of fatty acids, etc., are used as emulsifiers for W/O type emulsions. W/O emulsion gives homogeneous mixture (colour) by adding oil

# soluble dye. Separation of components of an emulsion is called demulsification.

MULTIPLE CHOICE QUESTIONS

1. The energy released during physiserption is

The energy released during physiserption
 (a) 10 - 20 kJ mol<sup>-1</sup>
 (b) 20 - 40 kJ mol<sup>-1</sup>

(c) less than 10 kJ mol<sup>-1</sup> (d) more than 40 kJ mol<sup>-1</sup>

Chemisorption is also known as
 (a) van der Waals' adsorption

(b) Langmuir adsorption

(c) Lewis Kossel adsorption (d) Faraday adsorption.

The surface of 1 g of adsorbate is maximum with

the particles are in
(a) cubic form
(b) powder form

(c) colloidal form (d) vapour form

4. Physisorption is generally high at

Physisorption is generally high at
 (a) high temperature (b) low temperature
 (c) low pressure

(d) equal in all these conditions.

5. When  $\log \frac{x}{m}$  is plotted against  $\log P$ , the slope is  $\frac{1}{2}$  and the intercept is 0.301. What will be the extent of

adsorption when pressure is 9 units?
(a) 2 (b) 3 (c) 6 (d) 9

The following volumetric analysis reaction of oxalic acid against KMnO<sub>d</sub>/ H\* is catalysed by the product MnSO<sub>d</sub>: The catalysis is an example of

 $2KMnO_4 + 3H_3SO_4 + 5H_2C_2O_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 10CO_2$ (a) homogeneous catalysis

(a) heritogeneous catalysis (b) autocatalysis

(c) induced catalysis (d) both (a) and (b).

7. Na<sub>2</sub>AsO<sub>2</sub> + O<sub>2</sub>(air) → No reaction

7.  $Na_3AsO_3 + O_2(air) \xrightarrow{\Delta} No reaction$  ...(ii)  $Na_2SO_3 + \frac{1}{2}O_2(air) \xrightarrow{\Delta} Na_2SO_4$  ...(iii)  $Na_2SO_3 + Na_3AsO_3 + O_2(air) \xrightarrow{\Delta}$ 

Na<sub>2</sub>SO<sub>4</sub> + Na<sub>3</sub>AsO<sub>4</sub> ...(iii) The reaction (iii) is an example of

is (a) autocatalysis (b) induced catalysis
(c) neutron catalysis (d) between entry catalysis

(c) negative catalysis (d) heterogeneous catalysis.

8. CH<sub>2</sub>OH ZSM-5 CH<sub>3</sub> Polymerisation casoline

Here, ZSM-5 works as

(a) susto-related (b) indused satisfied

(a) autocatalyst (b) induced catalyst (c) homogeneous catalyst (d) shape selective catalyst.

Which of the following is not correct w.r.t. catalysis?
 It may undergo physical changes only:

(a) It may undergo physical changes only.
 (b) Its quantity used in a reaction depends upon the quantity of reactants.

quantity of reactants.

(c) It does not after the enthalpies of reactants, products and the reaction.

and the reaction.

(d) It gives new mechanism to the reaction.

10. For the hypothetical reaction

 $2A + B \longrightarrow C + D$   $E_{ad} = 100 \text{ kJ creel}^{-1}$ ,  $E_{ab} = 100 \text{ kJ mol}^{-1}$ The nathalpy of reaction  $\Delta_c H$  would be

a) 300 kJ mol<sup>-1</sup> (b) 100 kJ mol<sup>-1</sup>

Sometime a non-protein part is joined with an enzyme for its working. The combination is called as
 (a) coenzyme
 (b) apoenzyme

(c) holoenzyme (d) allosteric enzyme.

12. Which of the following is an example of sol?

(a) Blood (b) Milk
(c) Butter (d) Coloured glass

13. Which of the following is not correct for Lyophilic colloid?

(a) Affinity for medium is very high.
(b) Need lyophobic sols as stabilizers.
(c) Viscosity is higher and surface tension is lower than DM.

Viscosity is higher and surface tension is lower than DM.
 (d) Electrophoresis is generally not shown.

formation of a micelle is called as

(a) critical temperature

(b) critical micelle temperature
(c) Kraft temperature (d) Boyle's temperature.

15. Which of the following has colloidal particles positively charged?

(a) Albumineids in blood (b) Au sel prepared by Bredig's method

(c) Fe(OH)<sub>3</sub> sol prepared by hydrolysis of FeCl<sub>3</sub>
 (d) As<sub>2</sub>S<sub>3</sub> sol prepared by passing H<sub>2</sub>S through suspension of As<sub>2</sub>O<sub>4</sub>

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- 16. Which of the following will have highest coagulation power for coagulation of [As-S-] S2- negative sol? (a) Na<sub>1</sub>PO<sub>4</sub> (b) Mgy(PO4)2
- (d) All equal (c) AIPO. 17. Which of the following will be used in lowest
- concentration for the coagulation of [Al(OH)<sub>1</sub>]Al<sup>5+</sup>
- positive sol? (a) K<sub>s</sub>[Fe(CN)<sub>s</sub>] (b) K<sub>1</sub>[Fe(CN)<sub>4</sub>]
- (c) K,PO, (d) KCI 18. Which colligative property is the best suited for
- experimentally finding the molar mass of colloidal particle of rubber in a sol?
- (a) ATc (b) ΔT<sub>6</sub> (d) RLVP 19. Tyndall effect was first studied by
- (a) Faraday (b) Tyndall (c) Zsigmondy (d) Hardy and Schulze.
- 20 80 mL of a negative sol requires 20 mL of 0.2 M NaCl for complete coagulation. The coagulation value
- of NaCl is (a) 16 (b) 40 (c) 400 (d) 4
- 21. A soap micelle generally contains RCOO" ions
- (a) upto 20 (b) 20 - 50 (d) 100 or more
- (c) 50 100 22. Deltas of rivers are formed because of
- (a) electrophoresis
- (b) increased Brownian movemen (c) coagulation
- (d) formation of lyophilic celleid.
- 23. Cottrell precipitator is used to.
- (a) remove carbon from smoke (b) purifying city water supply
- (c) study of colloids as impurity in a cas (d) all of these.
- 24. Tails of comets are visible du
- (a) Brownian movement (b) Tyndall effect
- (c) Achievement of Kraft temperature (d) Fast movement of colloidal particles.
- 25. Aqueous sol of which of the following cannot be prepared by Bredie's method?
- (c) Pt (d) Fe
- 3. (c)
- 4. (b):  $\Delta_{ads}G = \Delta_{ads}H T\Delta_{ads}S$ For adsorption  $\Delta_{ads}H$  and  $\Delta_{ads}S$  both are negative. For
  - adsorption to occur  $\Delta_{adv}$  G must be negative. For this T should be low or moderate, never high. Increase in
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- pressure will also force the molecules of gas to come closer to the surface of the adsorbent.
- 5. (c): log 2
- log k = 0 %0  $log k = 0.301 \implies k = 2$ 

  - $\frac{X}{2}$  (at P = 9 units) =  $kP^{\alpha} = 2 \times (9)^{2} = 6$
  - 6. (d): The product MnSO4 is catalyst so, it is an example of autocatalysis. The catalyst and the reactants are in the same phase,
- so, it is an example of humogeneous catalysis also. 5. (b): The quantity of a catalyst used does not depend
- upon the quantity of reactants. Its mere presence is
- and H = E Eat = 100 100 = 0
- 12. (a) Blood is an example of sol. Milk is an emulsion. Butter is a gel. Coloured glass is a solid sol.
- 13. (b): Lyophilic sols are self stable and are used as stabilizers for lyophobic sols. 14. (c)
- 15. (c): FeCl<sub>2</sub> + 3HOH 

  A Fe(OH)<sub>2</sub> + 3HCl :. Fe(OH), + Fe3+ ---- [Fe(OH), ]Fe3+
- 16. (c): Al3+ is effective ion and has highest positive charge among Na+, Mg2+ and Al3+.
- 17. (a): The most effective coagulating ion will have highest negative charge so, it is [Fe(CN)<sub>4</sub>]4-18. (c) : Only osmotic pressure is the measurable
- colligative property for rubber colloid because of its very high mass. C.P. «-
- 19. (a)
- 20. (b): 20 mL of 0.2 M NaCl = 20 x 0.2 millimoles of NaCl = 4 millimoles of NaCl (80 + 20) i.e., 100 mL of total dispersion needs 4 millimole NaCl
- 1000 mL of total dispersion needs NaCl = 40 millimoles 21. (d) 22. (c) 23. (a) 24. (b)
  - 25. (d): Water changes to steam which will react with Fe to produce Fe<sub>2</sub>O<sub>4</sub> and H<sub>2(e)</sub> in Bredig's method

CLASS XII



Practice Paper 2019

Practice paper for CBSE Exams as per the latest pattern and marking scheme issued by CBSE for the academic session 2018-19.

All questions are compulsory

- Section A. Q.no. 1 to 5 are very short answer questions and carry 1 mark ea
- Section 8: 0 no. 6 to 12 are short answer cuestions and carry 2 marks each (b) Section C: Ono. 13 to 28 are also short arroses ou extrem and carry it makes a
- (b) Section 0: Q no. 25 to 27 are long answer crestions and carry 5 mails each 66 There is no overall choice. However an internal choice has been provided in two questions of one mark, two questions of two marks, four questions of three
- marks and all the three questions of five marks weight tage. The have to attempt only one of the choices in such questions.
- (vii) Use log tables if recessary, use of calculaturs is not allowed

Time Allowed: 3 hours

1. Why is it necessary to remove CO when ammenia is obtained by Haber's process? 2. What happens to sodium chloride structure when

high pressure is applied to it? Why is the Frenkel defect not found in pure alkali

metal halides? Why is CO a stronger ligand than CI ?

4. During curdling of milk, what happens to sugar 9. present in it?

5. Define the term, 'homopolymerisation' with an example.

What are biodegradable polymers? Give one example.

Maximum Marks : 70

6. Why do doctors advise gargles by saline water in case of sore throat?

What will be the degree of dissociation and van't Hoff factor of a 0.1 M monobasic acid, if its pH is

How are polymers classified based on their source? 8. Write the reactions for obtaining benzaldehyde from benzal chloride and then benzal chloride from it.

Explain why sodium metal can be used for drying diethyl ether but not ethyl alcohol?

Answer the following: (i) Why do phenols not give the protonation reaction readily? (ii) Write down the resonance structure of phenol.

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- The rate for the formation of C, for the reaction given below, is 2.2 × 10<sup>-3</sup> mel L<sup>-1</sup> min<sup>-1</sup>.
   2A + B → C
- What is the value of  $-\frac{d[A]}{dt}$ ?
- Indicate the steps in the preparation of
   (i) K-Cr-O- from chromite ore
- K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> from chromite ore
   KMnO<sub>4</sub> from pyrolusite ore.
- Explain:

   NF<sub>3</sub> is an exothermic compound whereas
   NCI<sub>2</sub> is an endothermic compound.
  - (ii) 1, ion exists but F, does not.
- SECTION-C

  13. (i) Sodium chleride is an insulator in selid state
- but conductor in aqueous solution. Explain why.

  (ii) What kind of magnetic properties is exhibited
- by ions of NaCl?

  (iii) What types of defects generally observed in sodium chloride?
  - 14. (i) Explain the solubility rule "like dissolves like" in terms of intermolecular forces that exist in solutions.

    (ii) Why is it not possible to obtain gure ethanol.
    - by fractional distillation? What general mane is given to binary mixtures which show deviation from Raoult's law and whose components cannot be separated by fractional distillation. How many types of such mixtures

Phenol associates in benzene to a certain extent to form a dimer. A solution containing 20 g of phenol in 1.0 kg of henzene has its freezing point lowered

- by 0.69 K. Calculate the fraction of phenol that has dimerised.
- [Given, K<sub>f</sub> for benzene = 5.1 K kg mol<sup>-1</sup>]

  15. Write the equation of the reaction of the hydrogen include with
  - (i) 1-propoxypropane (ii) methoxybenzene

are there?

- (iii) benzyl ethyl ether.16. How will you distinguish between the following
  - How will you distinguish between the pairs of compounds?

    (i) Phenol and benzoic acid
  - (ii) Benzoic acid and ethyl benzoate (iii) Formic acid and acetic acid
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How will you convert?

(i) Benzeyl chloride to benzaldehyde (ii) Propanone to 2-propanol

(iii) Benzoic acid to m-nitrobenzoic acid
(Write the practices and state the

(Write the reactions and state the reaction conditions in each case).

- conditions in each case).

  17. Rearrange the compounds of each of the following the compounds of each of the compound of each of e
  - sets in order of reactivity towards \$\cdot 2\ displacement :

    (i) 2-Beome-2-methylbutane.
  - 1-Bromopentane, 2-Bromopentane
     (ii) 1-Bromo-3-methylbutane, 2-Bromo-2-methylbutane, 3-Bromo-2-methylbutane
  - methy@utane,3-@romo-2-methy/butane

    (iii) 1-Bromo-butane, 1-Bromo-2, 2-dimethy/
    propane, 1-Bromo-2-methy/butane.
- 18. (i) A child when dropped his soap in a bathing tub, the soap did not sink but was floating.
- Suggest the method of manufacturing such scap.

  (ii) Diabetic patients' are advised to take artificial sweeteners instead of natural sweeteners.
- Why?

  (iii) What is meant by a 'broad spectrum antibiotic'? Give an example.
- Predict towards which electrode would an α-amino acid migrate in an electric field at
   pH < pl, (b) pH > pl and (c) pH = pl
- Explain.
  OR
- Define the following terms as related to proteins :
- (i) Peptide linkage (ii) Primary structure
- (iii) Denaturation
  20. Answer the following:
- (i) Higher melecularity reactions (viz. molecularity = 4 and above) are very rare. Why?

  (ii) In some cases, it is found that a large number
- of colliding molecules have energy more than the threshold energy, yet the reaction is slow. Why? (iii) For a reaction A → products, it is found that the
  - rate of reaction doubles when concentration of A is increased four times. Calculate the order of reaction.
- 21. Explain the terms with example :
- (i) Aerosol
- (ii) Reversible sol
  (iii) Multimolecular and macromolecular colloids.

- 22. Write chemical reactions taking place in the extraction of zinc from zinc blende.
- extraction of zinc from zinc blende.

  23. Explain why

  (i) The ionization energies of 5d-elements greater
  - than 3d-elements.

    (ii) The E' value for the Mn<sup>3a</sup>/Mn<sup>2a</sup> couple is much
- more positive than that for  $Cr^{3\sigma}/Cr^{2\sigma}$  or  $Fe^{3\sigma}/Fe^{2\sigma}$ . (iii)  $Cu^+$  ion is not stable in aqueous solutions.
- Explain on the basis of VBT that [Co(NH<sub>3</sub>)<sub>0</sub>]<sup>3n</sup> is an inner orbital complex whereas [Ni(NH<sub>3</sub>)<sub>0</sub>]<sup>2n</sup> is an outer orbital complex.

OR

Write the IUPAC name and draw the structures of

- (ii) [PtCl<sub>2</sub>(C<sub>2</sub>H<sub>4</sub>)]<sup>-</sup>
- (i) Explain why mineral acid is added in excess in the diazotisation of arylamines.
  - (ii) An organic compound 'A', C<sub>7</sub>H<sub>2</sub>N on reaction with nitrous acid gave benzyl alcohol. Predict the structure of the compound and give its various isomeric structures.
    - OR

Give reasons for the following :

(i) (a) Ethylamine is soluble in water when

- aniline is not soluble in water.

  (b) Primary amines have higher becling point than tertiary amines.
- (ii) Give the structures of A, B and C in the following reactions:
- (a)  $C_qH_qN_1^*Cl^{-CoCN} > A \xrightarrow{H_qCHH} > B \xrightarrow{NH_q} > C$
- (b)  $C_6H_5NO_2$  A  $B_6OH^*$  C
- (c) CH<sub>3</sub>CN H<sub>2</sub>OH<sup>3</sup> → A NH<sub>3</sub> → B H<sub>2</sub> \* KUH → C
   (i) Write the name of the cell which is generally used in transistors. Write the reactions taking
- used in transistors. Write the reactions taking place at the anode and the cathode of this cell. (ii) Calculate the standard electrode petential of Ni<sup>2</sup>\*/Ni electrode if emf of the cell
- $N_{(q)} | N_1^{2+} (0.01 \text{ M}) | Cu^{2+} (0.1 \text{ M}) | Cu_{(q)} \text{ is } 0.059 \text{ V}.$ [Given:  $E_{c_1, c_2, c_3}^{e_1} = + 0.34 \text{ V}$ ]

OR

- Answer the following:

  (i) Define the terms specific conductance and equivalent conductance.
- (iii) Silver is electrodeposited on a metallic vessel of surface area 800 cm<sup>2</sup> by passing a current of 0.2 amperes for 3 hours. Calculate the thickness of silver deposited. The dentity of
- thickness of silver deposited. The density of silver is given as 10.47 g/cc and atomic mass of silver (Ag) is 107.92 g mol<sup>-1</sup>.
- 27. (i) Give reason for the following:

  (a) CN" ion is known but CP" ion is not
  - known.
    (b) NO- dimerises to form N-O.
  - (b) NO<sub>2</sub> dimerises to form N<sub>2</sub>O<sub>4</sub>.(c) ICI is more reactive than I<sub>2</sub>.
    - Hydrogen halides are covalent compounds but their aqueous solutions can conduct electric current. Explain.
  - newer the following:
  - What are the conditions to get the maximum yield of sulphuric acid by contact process?
  - anomalous behaviour.

    (iii) Balance the given chemical equation:

    XeF<sub>e</sub> + H<sub>2</sub>O → XeO<sub>2</sub>F<sub>2</sub> + HF
- SOLUTIONS

  1. Carbon monoxide acts as a poison for the catalyst
  Fe, used in the Haber's process. Hence, it is necessary to
- remove CO.

  2. When pressure is applied to NaCl structure (coordination number = 6 : 6), it changes to CsCl
- structure (coordination number 8 : 8).

  OR

during curdling of milk.

- Alkali metal halides have similar size of cations and anions, thus Frenkel defect is absent in them.
- 3. It is because CO can form  $\sigma(\text{sigma})$  as well as
- π-bond therefore, it is stronger ligand than CΓ.

  4. Lactose, the milk sugar is converted to lactic acid
- A polymer made by polymerisation of a single monomer is known as hemopolymer and the process is known as homopolymerisation e.g., polythene made by polymerisation of ethene molecules.

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### nCH, - CH,-> +(CH, -CH;)

Biodegradable Polymers : The natural polymer, which disintegrates by itself or by microorganisms within certain period of time is called biodegradable polymer, e.g., PHBV (poly-β-hydroxybutyrate-co-βhydroxyvalerate)

6. Sore throat is caused by viral and bacterial infection. When we gargle with salt water, there is a higher salt concentration than that of the infected cells. Through osmosis, water comes out of bacterial cells and infected cells thus, killing the pathogens and causing relief.

i.e., 
$$[H^{+}] = C\alpha$$
  
But  $[H^{+}] = 10^{-2}$  M [: pH = 2]  
:.  $C\alpha = 10^{-2} \implies \alpha = \frac{10^{-2}}{C} = \frac{10^{-2}}{0.1} = 0.1$ 

Van't Hoff factor (/) =  $=1+\alpha=1+0.1=1.1$ Polymers are classified into thro Type Example

cellulose resins and rubber Semisynthetic mthetic Benzaldehyde can

9. Due to the presence of an active hydrogen atom, ethyl alcohol reacts with sodium metal.

 $2CH_1-CH_2-OH+Na\longrightarrow 2CH_1-CH_2-ONa+H_2$ Diethyl ether on the other hand does not have replaceable hydrogen atom therefore does not react with sodium metal hence can be dried with metallic sodium.

(i) In phenols, the lone pairs of electrons on the oxygen atom are delocalised over the benzene ring

due to resonance and hence, are not easily available for protonation

= 4.4 × 10<sup>-3</sup> mol L<sup>-1</sup> min<sup>-1</sup>

4FeCr2O4+8Na2CO3+7O2→ 8Na,CrO4 + 2Fe,O4 + 8CO,  $2Na_2CrO_4 + 2H^* \rightarrow Na_2Cr_2O_7 + 2Na^* + H_2O$ Na-Cr-O- + 2KCl → K-Cr-O- + 2NaCl

(ii) 2MnO++4KOH+O+ - A 2K+MnO++2H+O 3MnO, +4H → 2MnO, + MnO, +2H,O 12. (i) NF<sub>3</sub> is an exothermic compound whereas

NCl. is an endothermic compound because during NFformation strong N-F bond is formed due to small size of F and large electronegativity difference between two atoms, while formation of NCl, leads to comparatively weaker N-Cl bond due to large size of Cl and nearly same electronegativities of the two atoms. (ii) If Fo is formed, then central F-atom would have

10 electrons in its valence shell. But that is not possible because F cannot expand its octet due to the absence of d-orbitals. Hence, F1 does not exist. On the other hand, 17 can expand its octet due to presence of d-orbital and therefore, exists

 In solid state of sodium chloride (NaCl). cations (Na\*) and anions (ClT) are held together by strong electrostatic (coulombic) forces hence, it does not carry electrical charges and behaves as an insulator. But in the presence of water, sodium chloride hydrolyses

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and split into cations (Na+) and anions (ClT) which are 15. (f) free to move and carry electrical charges through the CH2CH2CH3-O-CH3CH3CH3 aqueous medium and thus behaves as a conductor.

NaCled Hand Nation + Client

(ii) The electronic configuration of Na\* (1s22s2p6) and that of Cl (1s22s2p63s23p6) suggests that both of ions doesn't have any unpaired electron. Hence, both the ions (Na\* and Cl\*) will exhibit diamagnetic properties. (iii) Schottky defect (results in decreased density) and metal excess defect (generation of F-centres) which imparts colour to the crystal.

14. (i) A substance dissolves in a solvent if the intermolecular interactions are similar in both the components. Hence, polar solutes dissolve in polar solvents and non-polar solutes dissolve in non-polar solvents

(ii) Some liquids on mixing, form azeotropes which are binary mixtures having the same composition in liquid and vapour phase and boil at a constant temperature. In such cases, it is not possible to separate the components by fractional distillation. There are two types of azeotropes.

(a) Minimum boiling azeotropes : The solutions which show positive deviation from Racult's law form minimum boiling azeotropes at a specific composit (b) Maximum boiling azeotrope: The solutions which show negative deviation from Raoult's law and form maximum boiling azeotropes at a specific composit

OR Here, n = 2 because phenol forms dimer on  $W_1 = 20 \text{ g}, W_2 = 1 \text{ kg} = 1000 \text{ g}, \Delta T_2 = 0.69 \text{ K}$ 

Kr = 5.1 K kg mol-1

of Cu<sub>2</sub>O whereas acetic acid does not give these tests.  $M_{2|observed|} = 147.82 \text{ g mol}$ 

 $C_0H_0OH = 6 \times 12 + 6 \times 1 + 16 = 94 \text{ e mol}^{-1}$ 

2C,H,OH === (C,H,OH)-

373 K CH,CH,CH,CH,I + CH,CH,CH,OH 1-lode propune CH-CH-CH-O-CH-CH-CH- + 2HI

> >2CH;CH;CH OCH.

C-CH, bond weaker than O-CaHs, therefore, O-CH2 bond undergoes cleavage more easily to form phenol and iod

16. 10 Phenol will give characteristic blue/violet oleuration with neutral ferric chloride while benzoic acid will not Benzoic acid will liberate CO- with effervescence from

an aqueous solution of NaHCO, whereas phenol will

(iii) Ethyl benzcate on hydrolysis with dil. H-SO, gives a mixture of ethyl alcohol and benzoic acid. Due to formation of ethyl alcohol, this mixture will respond to iodoform test giving a yellow precipitate whereas benzoic acid alone does not give iodoform test (iii) Formic acid will reduce (i) Tollen's reagent to give

silver mirror and (ii) Fehling's solution to give red ppt. (i) Benzovl chloride is subjected to Rosenmund

(ii) Propanone is subjected to undergo reduction with H- in presence of Ni. Pt or Pd.

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2-propagal
(iii) By carrying out nitration of benzoic acid:
COOH
COOH

w-nitrobrusic acid

17. (i) 1-Bromopentane > 2-Bromopentane >
2-Bromo-2-methylbutane

(ii) 1-Bromo-3-methylbutane > 3-Bromo-2methylbutane > 2-Bromo-2-methylbutane

(iii) 1-Bromobutane > 1-Bromo-2-methylbutane > 1-Bromo-2,2-dimethylpropane 18. (i) Soaps that float on water are made by beating

tiny air bubbes before hardening them.

(ii) Talbetic patient's body does not produce enough insulin to metabolice natural sugars. As a result, sugars remain in the bods and affect leves, kidneys and beart. Therefore, dishetic patients are advised to take artificial sweeteness such as a saccharin. It is not metaboliced to be body and is excreted as such from the body under causing any dismage to livere, kidneys and beart (iii) The antibiotic which is effective against a work range of Gram positive and Gram range of Gram positive and Gram gauge between

is known as broad spectrum antihiotic, for example, chloramphenicol.

19. Isoelectric point of an amino acid is that pH at which there is no net migration of the amino acid

occurs in an electric field. It is sometimes represented as pl. Therefore, (a) Below the pl.(pti.< pl), the awiter ion will accept

 $H^{+}$  and exist as the cation.  $NH_{3}$ —CH— $COC^{+}$   $H^{+}$   $\longrightarrow H_{3}N$ —CH—COCH

A Therefore, migration will be towards the cathode.

(b) Above the pl (pH > pl), the zwitter ion will release proton and will exist as anion.

NH3-CH+COO-→H2N-CH-COO-

Therefore, migration will be towards the anode.

(c) At pH = pl, there is no net charge, therefore, there is no migration.

OR

 Proteins are the polymers of α-amino acids linked by amide formation between carboxyl and amino group. This is called peptide linkage or peptide bond ε.g.,

(ii) The specific sequence in which the various or-amino acids present in a protein are linked to one another is called its primary structure. Any change in the primary structure creates a different protein.

(iii) The loss of biological activity of a protein by changing the pH, temperature or by adding some salt due to disruption of the mainey structure of protein is called denaturation. During denaturation secondary and terrary structure of protein is destroyed but perimers structure remains infact.

20. (j) True nodecularity is the number of molecules which indergo simultaneous cellision to bring about a recasion. As the chances of simultaneous collision decrease with an increase in the number of reactant molecules, the molecularity zarely exceeds 4.
(ii) When the reactant molecules are not properly

criented in space for an effective collision, the reaction speed becomes low although, colliding molecules have more energy than threshold energy.

(iii) Initial rate = k[A]\* ...(i) (where, n = order of reaction)
When the rate of reaction doubles, then
2 × rate = k[4A]\* ...(ii)

 $2 \times \text{rate} = k[4A]^n$ Dividing eqn (i) by eqn (ii), we get

 $\frac{1}{2} = \left(\frac{1}{4}\right) \implies 1 = 2n$   $\therefore \text{ Order of reaction, } n = \frac{1}{2}$ 

 (i) Aerosol: If the dispersion medium is air with dispersed phase liquid or solid, it is called aerosol e.g., Smoke (carbon particles in air) and Fog (water vapours in air).

(ii) Reversible Sol: These are the sols in which dispersion medium can be separated from dispersion medium can be separated from dispersion medium can be separated from dispersion from the dispersion fro

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22. The steps involved are:

Concentration: When zinc blende is used, the powdered ore is concentrated by froth-floatation process. Roasting: The concentrated one is heated in excess of oxygen at about 900 °C. Zinc sulphide is exidised to zinc oxide. If some of the ore is oxidised to zinc sulphate, it

also decomposes at 900 °C into ZnO. 2ZnS + 3O, 900°C > 2ZnO + 2SO,

ZnS + 2O - 900°C - ZnSO  $2ZnSO_4 \longrightarrow 2ZnO + 2SO_1 + O_2$ 

For roasting, a reverberatory furnace may be used. Reduction: The principal reaction that takes place during reduction is the conversion of the oxide into the metal with the help of carbon.

ZnO + C 1673 K Zn + CO Electrolytic refining: Purification of zinc is done by electrolytic refining using pure Zn as cathode and impure Zn as anode. The electrolyte is ZnSO4-Reaction at cathode :  $Zn^{2n}_{(aq)} + 2e^- \rightarrow Zn_{(a)}$ 

Reaction at anode: 2H2Ott - O2fet + 4H tant + 4e ZnSO, electrolyte is added from time to time. 23. (i) In the 5d-series, after lanthanum (Z = 57) there is unexpected decrease in size due to lanthanide contraction. As a result, the effective pull of nuclear charge on valence electrons is more in case a 5d-elements than in 3d-elements and hence ionization

energies of 5d-elements are greater than that ch 3d-elements (ii) The high reduction potential of Mn3+/M couple is due to the reason that Mo 30 (3d4) by accepting an electron acquires very stable 3d electronic

configuration.  $Mn^{3+} + e^{-} \longrightarrow Mn^{2+}$ 

[Ari3d4 [Ari3d] But no such stability is gain during this change in case of Cr3+/Cr2+ (3d1) and Fe3+/Fe3+ (3d5), therefore, E4

value is less positive than that of Mn3+/Mn2+ (iii) Cu\* ion is less stable than Cu2\* ion in aqueous solution and hence undergoes disproportionation.  $2Cu^{+}_{(as)} \longrightarrow Cu^{2+}_{(as)} + Cu_{(s)}$ Cu lou) is more stable than Cu (as) due to more negative

enthalpy of hydration which more than compensates for the second ionisation enthalpy of Cu. 24. Oxidation number of Co in [Co(NH<sub>1</sub>)<sub>6</sub>]<sup>3+</sup> = +3

Co(27): [Ar] 11 11 1 1 1

Co3+ : [Ar] 11 1 1 1 1

Co3+ with strong ligand NH3

[Co(NH<sub>2</sub>)<sub>2</sub>|3+ : [Ari [1], 1], 1] x | x

(inner orbital complex) Oxidation number of Ni in [Ni(NH<sub>3</sub>)<sub>6</sub>]<sup>2+</sup> +12

Ni(28) -[Ar] [1] 1] 1] 1

Ni<sup>2+</sup>: [Ar] 11 11 11 Ni2+ with NH<sub>3</sub> ligand

[Ar] [1 1 1 1 1 1

(iii) Trichloroetheneplat



- 25. (i) During diazotisation, excess of mineral acid is added and normally, one mole of amine is treated with approximately three moles of the acid because.
- approximately three moies of the acid recause:

  (a) one mole of an acid is used up in dissolving the amine.

  (b) one mole of the acid is used to produce HNO<sub>2</sub>

  from NaNO<sub>3</sub>.
- from NaNO<sub>2</sub>.

  (c) one mole of the acid is required to maintain the proper acidity of the reaction mixture to prevent couoling of the diazonium salt.
- (ii) Since, the compound 'A' on treatment with HNO<sub>2</sub> gives benzyl alcohol, it implies that the compound must be benzylamine. Thus,

Benzylarine Benzylakohol

The various isomeric structures of the compound (A),

CH, CH,

(i) (a) Ethylamine is soluble in water doe to formation of intermolecular flythece bonds with water molecules. However, in anilino due to large hydrophobic aryl group the extent of hydrogen bonding decreases considerably and bence arise is insoluble in water.
(b) Primary angines (R-NH<sub>2</sub>), have two hydrogen

atoms on nitrogen inhich can undergo intermolecular hydrogen bottoling whereas no such hydrogen bonding is present fit retriary amines (R<sub>2</sub>N). So, primary amines boil at a higher temperature than tertiary amines. (ii) [a] C<sub>0</sub>H<sub>2</sub>N<sub>2</sub>CT<sub>2</sub>SES → C<sub>0</sub>H<sub>2</sub>CN — 18,000°

$$C_6H_5CONH_2 \leftarrow \frac{NH_9}{\Delta} - C_6H_5COOH$$
(C)
(B)
 $C_6H_5NO_2 \xrightarrow{Son+HCl} + C_6H_5NH_2 \xrightarrow{NaNO_2 + HCl} \xrightarrow{reg \ g'}$ 

- CH<sub>2</sub>CN H<sub>2</sub>COOH → CH<sub>2</sub>COOH<sub>2</sub> → CH<sub>2</sub>CONH<sub>2</sub>
- 26. (i) Mercury cell is generally used in transistors.
  At cathode: HgO + H<sub>2</sub>O + 2e<sup>-</sup> → Hg + 2OH<sup>-</sup>
  At anode: Zn(Hg) + 2OH<sup>-</sup> → 2nO + H<sub>2</sub>O + 2e<sup>-</sup>
  (ii) Nt<sub>1,0</sub> + Cu<sup>2</sup><sub>1,0</sub> → Cu<sub>1,0</sub> + Ni<sup>2</sup><sub>1,0</sub> + 2e<sup>-</sup>
- $E_{cell} = E_{cell}^* \frac{0.059}{n} log \frac{[Ni^{2+}]}{[Col^{2+}]}$
- $0.059 = E^{\alpha}_{coll} \frac{0.059}{2} \log \left( \frac{0.01}{0.1} \right)$  [Here, n = 2]
- $0.059 = E_{ccl}^0 \frac{0.059}{2} (-\log 10)$
- $0.059 = E_{coll} + \frac{0.059}{2} \implies E_{coll} = 0.059 \frac{0.059}{2}$
- Nov. E cat = E cathede E arode 0.03 = 0.34 - E arode E arode = 0.34 - E arode
  - E'mode = 0.34 0.03 = 0.31 V Hence, E'xc<sup>20</sup>pci = + 0.31 V (i) Specific conductance : It is the conductance due to ions present in 1 cm<sup>2</sup> of electrolytic solution.
  - Equivalent conductance  $(\Lambda_{eq})$ : It is the conductance of an electrolytic solution containing 1 gram-equivalent of the electrolyte. The solution is contained in between two electrodes which are 1 cm apart. (ii) The electrode half-reaction is given as:  $\Lambda \sigma^* + \sigma^* - \Delta \sigma$
  - The quantity of electricity passed = 0.2 A × 3 × 60 × 60 s = 2160 C 96500 C electricity will deposit = 107.92 g Ag
    - 2160 C will deposit =  $\frac{107.92 \times 2160}{96500}$  = 2.42 g Ag
  - Let the thickness of the deposit be x cm.

    Mass = Volume × Density = (Area × Thickness) × Density
  - er  $2.42 \text{ g} = 800 \text{ cm}^2 \times x \text{ cm} \times 10.47 \text{ g/cc}$  $\therefore x = \frac{2.42}{800 \times 10.47} = 2.89 \times 10^{-4} \text{ cm}$
  - 800×10.47

    27. (i) (a) Due to smaller size and higher electronegativity than phosphorus, N is able to form px.em multiple bonds with C and hence, forms :C ≡N:



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ion but due to bigger size and lower electronegativity. P is unable to form multiple bonds with C and, hence, does not form : C = P": ion.

(b) NO<sub>3</sub> is an odd electron species (7 + 8 + 8 = 23 electrons) with odd electrons present on N and therefore, in order to get more stability, the two odd

electrons pair up to form the dimer N2O4.

(c) As I-Cl bond is weaker and hence more reactive because of its partly ionic character due to difference in electronegativity. But In I., same halogen atom form covalent bond and hence less reactive.

(ii) All the hydrogen halides, i.e., HF, HCl, HBr and HI are distinctly covalent compounds but the bond between H and halogens (X) is pelar. In aqueous solution, these hydrogen halides are able to release proton to be accepted by H2O and furnishes H2O\* and

X' ions, therefore conduct electricity.  $H - X + H_2O \longrightarrow H_2O^* + X^*$ 

(i) In H-SO<sub>4</sub>, production key step is

 $2SO_{Nel} + O_{Nel} = 2SO_{Nel} : \Delta_f H^o = -196.6 \text{ kJ mol}^{-1}$ So according to Le-chatelier's principle, reaction must be carried out at optimum temperature (226 K) and

at high pressure (2 bar) in the presence of V2Os as a catalyst (iii) Fluorine exhibit anomalous behaviour due to

small size, high electronegativity and absence of vacant d-orbital.

The two examples are: (a) Since fluorine is most electropegative element, it shows only a negative exidation state of -1. It does not

show any positive oxidation state. (b) Due to hydrogen bunding, HF can form acid salts of type KHF4 while other halopens acids do not form

dioxydiflooride

such compounds. (iii) XeF<sub>A</sub> + 2H<sub>2</sub>O → XeO<sub>2</sub>F<sub>2</sub> + 4HF Хепоп

MINIBEVENET

2. NEXHPYALOTI

3. ALNMARIN 4. LMILUTE

5. ETGORMIRENE

TANMRYE 7. PASNISNO

8. LRICONO 9. FKNINNESCERA

10. CMHISAOLROHM

the weight of a known vol It is a trop of herbicide, a triazine d It is widely used in agriculture to control broad-leaved and grass w

A toxic substance that acts like an antibiotic that is produced by plants to inhibit or kill the growth of microon

A type of gummy material from tree uents are pentacyclic terper

It is an aluminium silicate, formed by heating other aluminosilicates. It is d in ref actories and glasses es to the colour change that o

n to a solution of a compo It is a white crystalline substance which turns red w in exposed to air and



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# MONTHLY TUNE UP!

# PRACTICE PROBLEMS

These practice problems enable you to self analyse your extent of understanding of specified chapter. Give yourself four marks for connect answer and deduct one mark for wrong answer. Performance analysis table given at the end will help you to check your readness.

Organic Compounds Containing Nitrogen

### Total Marks: 120

# NEET / AllMS Only One Option Correct Type

- Oxidation of 2-aminopropane with KMnO followed by hydrolysis forms a compound that can
   (a) give indoform test
  - (b) be reduced to secondary alcehol (c) form oximes
  - (d) give all the above properties
- In the following reaction, X is
   Bromination V NaNOy/HCL
   Be
  - (a) benzoic acid (b) salicytic acid (c) phenol (d) amiline.
- Amines are well known to be stronger bases and nucleophiles than alkenes. Why do enamines, such as NA-dimethylaminecyclopentene, reacts with electrophiles at a double bond carbon rather than at distinguish.
  - electrophiles at a double bond carbon rather than at filtrogen?

    (a) The nitrogen is sterically hindered by alkyl sub-tituents.
  - (b) Nitrogen is more electronegative than carbon.
    (c) Ammonium cations are less stable than carbocations.
  - (d) The carbocation formed by electrophilic attack at C-2 is stabilized by pi-bonding with the lone pair of electrons on nitrogen.

Compound (A) when treated with PCl<sub>5</sub> and then with NH<sub>3</sub> gave (B), (B) when treated with Br<sub>2</sub>/OH<sup>7</sup>

produced (C). (C) on treatment with NaNO<sub>2</sub> and H.G. at 0°C and then boiling with water forms o\_resol. Cempound (A) is (a) o-bromo toluene (b) o-chloro toluene

(c) o-teluic acid (d) m-teluic acid.

The amines shown here are isomers. Choose the one with the lowest beiling point.

(a) 
$$\bigcap_{CH_3}^{H}$$
 (b)  $\bigcap_{N}$ -NHCH<sub>3</sub>

(c) (d) (d) (...)

6. The most reactive amine towards dilute hydrochloric

### 7. A student tried to synthesize

4-nitro-N, N-dimethylaniline from N, N-dimethylaniline via electrophilic arematic substitution using nitric acid (HNO<sub>3</sub>) and sulphuric acid (H<sub>2</sub>SO<sub>4</sub>). To his surprise, the major product he obtained was 3-nitro-N, N-dimethylaniline. Why the designed next to failed to provide the designed modur?

- (a) The amine group is meta directing.

  (b) Protonation at amine group makes it meta
- (c) The amine group is strong electron withdrawing group by its -I effect.
- group by its =1 enect.

  (d) Steric inhibition to resonance is responsible for the above result.
- 8. A nitrogen containing organic compound gave an oily liquid on heating with bromine and potassium hydroxide solution. On shaking the product with acetic anhydride, an antipyretic drug was obtained. The reactions indicate that the starting compound is
- (a) aniline (b) benzamide (c) acetamide (d) nitrobenzene.
- (c) acetamide (d) nitrobenzene.

  When a primary amine reacts with chloroform and ethanolic KOH, then the product formed is
  - (a) isocyanide (b) aldehyde (c) cyanide (d) alcohol
- 10. Which of the following reactions does not yield
  - amine? (a)  $RX + NH_1 \longrightarrow$ 
    - (b) RCH = NOH + [H]
    - (c) RCN + H<sub>2</sub>O H<sup>\*</sup>
      (d) RCONH<sub>2</sub> + 4H HAB
- Ethyl amine can be obtained from methyl iodide by reaction with also helic RCN followed by
   (a) hydrolysis (b) reduction
   (c) dxidation (d) reaction with ammonia.
  - The best reagent for converting 2-phenylpropanamide icto 2-phenylpropanamine is

     (a) exccs. H<sub>2</sub>
     (b) Be<sub>2</sub> in aqueous NaOH
     (c) todine in the presence of red phosphorus

# (d) LiAlH<sub>q</sub>/ether. Assertion & Reason Type

Directions: In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

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- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true but reason is not the correct explanation of assertion.
- s (c) If assertion is true but reason is false.
  d (d) If both assertion and reason are false.
  - Assertion: Nitrobenzene is used as a solvent in Friedel-Crafts reaction.
     Reason: Fusion of nitrobenzene with solid KOH gives a low yield of a mixture of o- and
  - p-nitrophenols.
    14. Assertion: Aniline reacts with bromine water to form 2, 4, 6-tribromoaniline.
  - form 2, 4, 6-tribromoaniline.

    Reason: Amiline is resonance stabilized.

    15. Assertion: Ammonolysis of alkyl halides involves
  - reaction between alkyl halides and alcoholic ammonia: Reason a Ammonolysis of alkyl halides mainly
    - produces 2" amines.
      JEE MAIN / ADVANCED

# Only One Option Correct Type 16. CH<sub>2</sub>NH<sub>2</sub> reacts with α, β-unsaturated ketone as

- 9
- Select the correct statements out of 1, II and III.

  I. Product is by conjugate addition.
- II. It is called Michael reaction.

  III. Intermediate is zwitter ion which tautomerises
- after the proton transfer.
  (a) Only I. III (b) Only I. III
- (c) Only II, III (d) I, II, III

   Which of the following is regenerated at the end of the reaction?

$$p$$
-nitrophenol  $\xrightarrow{(i_2 i_3)_2 i_3 i_4 i_5} X \xrightarrow{Sa/HC_1} Y$   
 $NaNo_2/HC_1$   $C_4/i_4/OH_2$   $NaOH/C_2H_2$ 

$$San/HCI \rightarrow W \xrightarrow{NaNO_2/HCI} HBF_4 \rightarrow NaNO_2/Ca$$

(a) Z (b) Y (c) X (d) W 18. Amino ( $-NH_2$ ) group is susceptible to exidation by

HNO<sub>2</sub>, therefore, nitration is done in the presence of
(a) dil H<sub>2</sub>SO<sub>4</sub> (b) CS<sub>2</sub> at 0°C
(c) CH<sub>3</sub>COCl/py (d) water.

### 19. In the following reaction.

OCH-Productr

Choose the correct set of possible products from the following:

- (a) I and II only (b) L III and V only (c) II. III and V only (d) All of these
- More than One Options Correct Type

20. Which of the following sequence of reagents as good means to furnish the conversion?

- RCH-OH → R CH-NH-(a) KMnO<sub>4</sub>; SOCl<sub>5</sub>; NH<sub>5</sub>; heat; "OBto
- (b) PBr4; NaCN; H2, Ni

- (c) Collin's reagent: NH .: H .. Ni
- (d) Cu, 300°C; NH<sub>3</sub>, NaBH<sub>3</sub>CN 21. Which of the following reactions are correct?

(a) 
$$\xrightarrow{H}$$
  $CI + 2NH_3 \rightarrow \xrightarrow{H} NH_2 + NH_4CI$   
(b)  $\xrightarrow{H}$   $CI \xrightarrow{aq. KOH}_3 \rightarrow \longleftarrow$ 

- 22. Which of the following amines undergo acylation reaction? (a) CH-CH-NH-(b) C.H.NH.
  - (c) (CH,CH,),NH (d) (CH.), N the structural form of a compound A (CaH11N) is ssolves in dilute HCl and reacts with
    - NO. Compound (A) could be NHCH.
    - NHCH, NHCH.

# AMAZING FACTS YOU MUST KNOW



Thy onions make you cry?? activitizatory-factor synthase is released into the air when we cut an onior. The synthase enzyme converts the amino accis sulfoxides of the onion into sulferic acid. The unstable sulferic acid reamanges isself into ser-propagathial-S-poide. Ser-propagathial-S-poide pets into the air and comes in contact ith our eyes. The lachrymal glands become imitated and produces the tears!

# Why coffee keeps us awake? Adenosine is a hormone which is found in our brain and

this binds with our receptors and blocks it and causes drawsiness by slawing nerve cell activity. Coffee contains Caffeine which binds to adenosine molecule and slows down their activity. Caffeine also causes the production of

more Advenages which is known as "Fight Hormone" and this charge the body with energy and one feels excited and awake after drinking it. That is why coffee keeps us awake

# 70 People can heat up

the house!! How about you don't light things on fire instead, just heat your house up with people! It's easy, as humans sadiate around 150 watts on average, it would take only 70 people to warm up your place in the winter, as long as you keep them in constant motion

### Numerical Value Type

- 24. C<sub>c</sub>H<sub>13</sub>N(A) on reaction with HNO<sub>5</sub> forms 3º alcohol. What is the position of amino group in
- 25. The number of amines having pKs less than
- C.H.NH, among the following is p-CH<sub>2</sub>C<sub>4</sub>H<sub>4</sub>NH<sub>5</sub>,o-CH<sub>3</sub>C<sub>4</sub>H<sub>4</sub>NH<sub>5</sub>,m-CH<sub>3</sub>C<sub>4</sub>H<sub>4</sub>NH<sub>5</sub> C<sub>4</sub>H<sub>4</sub>N(CH<sub>3</sub>)<sub>5</sub> C<sub>4</sub>H<sub>4</sub>NHCH<sub>5</sub> p-NO<sub>3</sub>C<sub>4</sub>H<sub>4</sub>NH<sub>5</sub>
- p-CIC,HaNH, CaHaCHaNHa 26. m-Phenylenediammine when treated with NaNOand HCl at 0-5°C undergoes self-coupling reaction to produce a trimer, known as Bismarck brown. The total number of nitrogen atoms in the final product is

# Comprehension Type

A mixture containing salts of primary, secondary and tertiary amines along with a quaternary salt, is distilled with KOH solution. The three amines distil over, leaving the quaternary salt unchanged in solution, RaNI (non-volatile tetra-alkyl ammonium salt) has no reaction with KOH, however remains as residue. Then the mixture of amines can be separated by fractional distillation, Hinsberg's method and Hofmann's metho

- 27. Primary amine with Hinsberg's reasont forms (a) N-alkyl benzene sulphonamide soluble in KOH selution
  - (b) N-alkyl benzene sulphonamide insoluble i KOH selution
  - (c) N. N-dialkyl benzene sulphonamide soluble in KOH selution

(c) ethyl acetate

(d) diethyl exalate.

- (d) N, N-dialkyl benzene sulphonamide insoluble in KOH solution.
- 28. Hofmann reagent used in the separation of 1°, 2° and 3° annines is (a) benzene sulphonyl chleride (b) p-toluene sulphonyl chloride

### Matrix Match Type

- 29. Match the following: Column I Column II
- (A) Ethanamine (p) Amine which gives aze dye test (B) Diethylamine (g) Amine which can be
  - prepared by Gabriel phthalimide reaction
  - (C) Triethylamine (r) Amine which gives Liebermann nitroso reaction
  - (D) Aniline Amine which does not react with Grignard
    - (a) q (b) p 181.4
  - 30. Match the compounds in column I with their Column ! Column II
  - (P) CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CN 1. Reduction with Pd-C/H. (Q) CH<sub>2</sub>CH<sub>2</sub>OCOCH<sub>3</sub> 2. Reduction with
    - SnCl-/HCl (R) CH3-CH=CH-CH3OH 3. Development of foul smell on
      - treatment with KOH and CHCL (S) CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>-NH<sub>3</sub> 4. Reduction with diisobutyl aluminium

Keys are published in this issue, Search new! S

- hydride (DIBAL-H) 5. Alkaline hydrelysis
- (a) 1.3.4.5 (b) 1, 3, 4, 5 1, 4, 5 4.5 (c) 1, 2, 4, 5 2, 3, 4 (d) 1, 2, 4, 5 4,5

# CHECK YOUR PERFORMANCE

If your score is No of questions attempted > 80% Your preparation is going good, keep it up to get high score. No of quartiess cornect 60-80%. Need more practice, try hard to score more next time.

Marks scored in percentage Stress more on concepts and revise thoroughly



CHEMISTRY TODAY | FERRUSPY '19

## CHEMISTRY MUSING

PROBLEM **SET 67** 

Namisty Musing was started from August '12 issue of Chemistry Today. The aim of Chemistry Musing is to augment the I chances of bright students preparing for JEE (Main and Advances) / NEET / AIMS / JIPMER with additional study material. In every issue of Chemistry Today, 10 challenging problems are proposed in various topics of JEE (Main and Advanced) / NEET. The detailed solutions of these problems will be published in next issue of Chemistry Today The readers who have solved five or more problems may send their solutions. The names of those who send atleast five correct solutions will be published in the next issue. We hope that our readers will enrich their problem solving skills through "Chemistry Musing\* and stand in better stead while facing the competitive exams.

(d) 
$$H^{C=C}$$
  $H^{C=C}$   $H^{C=C}$ 

The energy levels of O and H atoms are shown in the figure. Assume that the molecular axis of OH molecule is z-axis

ct which of the following is correct about OH.

- The hond order is one. II. It is paramagnetic.
  - III. The \sigma-bonding molecular orbital is formed by linear combination of 2s-atomic orbital of O-atom and Is-atomic orbital of H-atom.
  - IV. There is high probability of formation of sigma bonding molecular orbital by linear 26.(8) 27. (a) 28. (d)

- combination of Is-atomic orbital of H-aton and 2p,-atemic orbital of O-atom. (b) II and III only (a) I and II only (c) L II and IV only (d) J. II. III and IV
- 3. Identify (X) in the following sequence of reactions.

- The catalytic decomposition of formic acid may take place in two ways:
- (ii)  $HCOOH \longrightarrow H_*O + CO$
- The rate constant and activation energy for

N	IONTH	Y.	TUNE UP	CL	ASS XII	7	INSV	VER.	KEY	
L	(d)	2.	(d)	3.	(d)	4.	(c)	5.	(c)	
ś.	(b)	7.	(b)	8.	(b)	9.	(a)	10.	(c)	
1	(b)	12	(d)	13.	(b)	14.	(b)	15.	(c)	
16	(d)	17	(c)	18.	(c)	19.	(b)	20.	(c,d)	
21	(acd)	22	(ahc)	23.	(a.c)	24.	(2)	25.	(5)	

reaction (i) are 2.79 × 10<sup>-3</sup> min<sup>-1</sup> at 237°C and 12.0 kcal mol<sup>-1</sup> respectively. These values for reaction (ii) are 1.52 × 10<sup>-4</sup> min<sup>-1</sup> at 237°C and 24.5 kcal mol<sup>-1</sup> respectively.

Find out the temperature at which equimolar quantities of H<sub>2</sub>O,CO,CO<sub>2</sub> and H<sub>2</sub> are formed.  $(R = 2 \text{ cal } \text{K}^{-1} \text{ mol}^{-1})$ 

(a) 667°C (b) 394°C (c) 777°C (d) 494°C 5. There are two paths to prepare 2-methylhex-1-en

Path I: 
$$C \equiv \ddot{C}Na^* + \frac{Be}{Me}$$
  $Me$ 

$$S = \frac{Me}{Me}$$

$$S =$$

Which of the following statements is comes (a) Only path I is feasible.

(b) Only path II is feasible. (c) Both paths are feasible.

(d) Both paths are not feasible.

#### JEE ADVANCED 6. 1.8 g of hydrogen atoms are excited to radiations. The study of spectra indicates that 27% of the atoms are in energy level III and 15% of the atoms are in energy level II and the rest are in the ground state.

IP of hydrogen is 13.6 eV. Calculate the total energy evolved when all the atoms return to ground state. (a) 108.4 kJ (b) 292.6 kl (c) 832.5 k) (d) 628.7 kJ

Among the various ores of metal (M), two ores (X) and

(Y) show the following reactions: (i) (X) on calcination gives a black solid (S), carbon

dioxide and water (ii) (S) disselved in dil. HCl which on reaction with KI

gives a white pot. (P) and iodine. (iii) (Y) on roasting gives metal (M) and a gas (G1)

which turns acidified K-Cr-O- solution green. CHEMISTRY TODAY | FRREUERY "19

(iv) (Y) on reaction with dil. HCl gives a white precipitate and another eas (G<sub>2</sub>) which turns lead acetate solution black and also reacts with eas (G1) to precipitate colloidal sulphur in presence of

The metal (M) gives greenish blue flame

7. The white ppt. (P) is of (a) Cu,I,

(b) Cut. (c) K<sub>2</sub>[Cul<sub>4</sub>] (d) none of the

8. Which of the following statements is correct about (a) (Y) is converted to metal (Af) by self-reduction. (b) (Y) is chalcopyrite

(c) Both of these

9. 88 g chunk of dry ice and 30 g of graphite were placed in 5 L container and the mixture was heated to achieve the equilibrium:

CO<sub>360</sub> + C<sub>60</sub> = 2CO<sub>66</sub> Calculate the value of K, (in atm) at 1000 K if the

resity of gas mixture is 18.3 g/L. 10. The isotopic composition of rubidium is 85Rb, 72% and ERb. 28%. ERb is weakly radioactive and decays by B-emission with a decay constant of

1.1 × 10°11 per year. A sample of the mineral pollucite was found to contain 450 mg of Rb and 0.72 mg of 85 Sr. The age of pollucite is

Fxam Notification: NEST 2019 servino admission to National Institute of Science Education and

## National Entrance Screening Test (NEST) is a compulsory test for students

Research (NISER) Bhubaneswar and University of Mumbai - Department of Atomic Energy Centre for Excellence in Basic Sciences (UM-DAE CEBS), Mumbai. Both NISER and UN-DAE CEBS were set up by Department of Atomic Energy, Government of India in 2007. Their mandate is to train scientific manpower for carrying out cutting edge scientific research and for providing input to scientific programmes of Department of Atomic Energy and other applied science institutions in the country, NEST 2019 will be conducted in around 91 cities across India The NEST 2019 exam shall be held at multiple centres across India on June 1, 2019 (Saturday) over two separate sessions. The timings for the

exams are as follows: Seegon 1 - 9 am to 12 30 pm & Seegon 2 - 2 30 pm to 6 pm Closing of Online application for NEST: Warch 11, 2019

Download of Admit Card beains: April 24, 2019 Announcement of results on NEST website: June 17 The information brochure, syllabus and application process for

examination is available on the official website of NIST 2019.





## SOLVED PAPER 2019

- In the Hall-Heroult process, aluminium is formed at the cathode. The cathode is made out of
   (a) platinum (b) pure aluminium
   (c) copper (d) carbon.
- What is the work function of the metal if the light
  of wavelength 4000 Å generates photoelectrons of
  velocity of ×10<sup>5</sup> m s<sup>-1</sup> from it?
   (Mass of electron = 9 × 10<sup>-31</sup> kg, Velocity of light,
  = 3 × 10<sup>8</sup> m s<sup>-1</sup>. Planck's constant = 6.626 × 10<sup>-38</sup> lis.
- = 3 × 10 ms , Plancks constant = 64.26 × 10 / 18 charge of electron = 1.6 × 10<sup>-19</sup> J eV<sup>-1</sup>) (a) 40 eV (b) 2.1 eV (c) 0.9 eV (d) 3.1 eV 3. A metal on combustion in excess in forms 3
- X upon hydrolysis with water yields H<sub>2</sub>O<sub>2</sub> and O<sub>2</sub> along with another product. The metal is (a) Li (b) Rh (c) Mg (d) Na
- (a) Li (b) Rb (c) Mg (d) 4. Two selids dissociate as fellows  $A_{\{e\}} \xrightarrow{\longrightarrow} B_{\{g\}} + C_{\{g\}}; K_{g_0} = x$  atm
- $D_{(g)} \rightleftharpoons C_{(g)} + E_{(g)}$ ;  $K_{p_2} = y$  ator<sup>2</sup> The total pressure when both the solids dissociate simultaneously is
  - (a)  $\sqrt{x+y}$  atm (b)  $x^2 + y^2$  atm (c)  $2(\sqrt{x+y})$  atm (d) (x+y) atm
  - (c) 2[\(\sqrt{x} + y\)] atm \(\sqrt{d}\) \((x + y\)] atm
    - 2 C CH<sub>3</sub> cannot be prepared by
  - (a) PhCOCH<sub>3</sub> + CH<sub>3</sub>CH<sub>2</sub>MgX (b) HCHO + PhCH(CH<sub>4</sub>)CH<sub>3</sub>MgX
  - (b) HCHO + PhCH(CH<sub>3</sub>)CH<sub>2</sub>MgX
    (c) PhCOCH<sub>2</sub>CH<sub>3</sub> + CH<sub>3</sub>MgX
- (d) CH<sub>2</sub>CH<sub>2</sub>COCH<sub>3</sub> + PiMgX

  6. Water samples with BOD values of 4 ppen and 10. In a chemical reaction, A+2B = C+D,
- Water samples with BOD values of 4 ppm and 18 ppm, respectively, are

- (a) clean and highly polluted
  (b) highly polluted and highly polluted
  (c) highly polluted and clean
  (d) clean and clean.
- The element with Z = 120 (not yet discovered) will be an/a
  - (a) inner-transition metal
    (b) alkaline earth metal
    - (c) alkali metal (d) transition metal
    - Gas H<sub>2</sub> CH<sub>4</sub> CO<sub>2</sub> SO<sub>2</sub> Critical 33 190 304 630 Temperature/K On the basis of data given above, predict which of the following gases shows least adsorption on
- a definite amount of charcoal?

  (a) H<sub>2</sub> (b) CH<sub>4</sub> (c) CO<sub>2</sub> (d) SO<sub>2</sub>

  9. The main product of the following reaction is

  CN (i) DIRAL-H
  - (a) CHO (b) CHO
    - (c) CHO
      CH=NH
      OH
      OH
      OH
  - In a chemical reaction, A+2B → 2C+D, the initial concentration of B was 1.5 times of

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the concentration of A, but the equilibrium concentrations of A and B were found to be equal. The equilibrium constant (K) for the aforesaid chemical reaction is

(a) 1 (b) 
$$\frac{1}{4}$$
 (c) 4 (d) 16

 Among the following four aromatic compounds, which one will have the lowest melting point?
 CH<sub>q</sub>

12. The standard electrode potential E temperature coefficient  $\left(\frac{dE^0}{dE^0}\right)$  for a cell

and  $-5 \times 10^{-4} \text{ V K}^{-1}$  at 300 K respectively. The cell reaction is  $Zn_{\{c_i\}} \leftarrow Zn_{\{c_i\}}^{2,*} \rightarrow Zn_{\{c_i\}}^{2,*} + Cn_{\{c_i\}} \rightarrow Zn_{\{c_i\}}^{2,*} + Cn_{\{c_i\}}$  in k1 mol<sup>-1</sup> is, [Vis, R = 8] K<sup>2</sup> mol<sup>-1</sup> and

in k| mol<sup>-2</sup> is, |Use R = 8 | K<sup>-2</sup> mol<sup>-2</sup> and  $F = 96,000 \text{ C mol}^{-2}$ , | (a) -412.8 (b) 192.0 (c) -384.0 (d) 206.413. The hardness of a water sample (in terms of

equivalents of CaCO<sub>3</sub>) containing 10<sup>-3</sup> M CaSO<sub>4</sub> is (molar mass of CaSO<sub>4</sub> = 136 g mol<sup>-2</sup>) (a) 10 ppm (b) 100 ppm (c) 30 ppm (d) 90 ppm

(c) So ppm (d) 90 ppm
14. Decomposition of X exhibits a rate constant of 0.05 µg/year. How many years are required for the decomposition of 5 µg of X into 2.5 µg?

decomposition of 5 µg of X into 2.5 µg?
(a) 25 (b) 50 (c) 20 (d) 40

15. The increasing order of reactivity of the fellowing compounds towards reaction with alkyl halides

directly is

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(a) (B)<(A)<(D)<(C) (b) (A)<(C)<(D)<(B) (c) (B)<(A)<(C)<(D) (d) (A)<(B)<(C)<(D) 16. Iodine reacts with concentrated HNOs to yield Y

along with other products. The oxidation state of ioding in F, is.

(a) (5 (b) 1 (c) 7 (d) 3

7. For a distormic ideal gas in a closed system, which of the following plots does not correctly describe

the relation between various thermodynamic quartities?

$$\begin{array}{c|c} C & C & C & C \\ \hline C$$

18. Mn<sub>2</sub>(CO)<sub>30</sub> is an organometallic compound due to the presence of

(a) C—O bond
(b) Mn—O bond
(c) Mn—C bond
(d) Mn—Mn bond

19. The main product of the following reaction is

- 20. The volume of gas A is twice than that of gas B. The compressibility factor of gas A is thrice than that of gas B at same temperature. The pressures of the gases for equal number of moles are
  - (a)  $2P_A = 3P_B$  (b)  $3P_A = 2P_B$ (c)  $P_A = 2P_B$  (d)  $P_A = 3P_B$
  - Among the following compounds most basic amino acid is
    - (a) histidine (c) asparagine
  - (c) asparagine (d) lysine.

    22. The correct order for acid strength of compounds
    CH≡CH, CH₁−C≡CH and CH₂=CH₂

(b) serine

- is as follows
  (a) CH<sub>3</sub>-C=CH > CH=CH > CH<sub>2</sub>=CH<sub>2</sub>
  (b) CH<sub>3</sub>-C=CH > CH<sub>2</sub>=CH<sub>2</sub> > HC=CH
  (c) HC=CH > CH<sub>4</sub>-C=CH > CH<sub>4</sub>-CH
- (d) CH≡CH > CH<sub>2</sub>=CH<sub>2</sub> > CH<sub>3</sub>−C≡CH 23. Polv-β-hydroxybutyrate-co-β-hydroxyvaleta
- Poly-β-hydroxybutyrate-co-β-hydroxyl (PHBV) is a copolymer of
   (a) 2-hydroxybutanoic acid and
  - 3-hydroxypentanoic acid
  - (b) 3-hydroxybutanoic acid and 3-hydroxypentanoic acid
  - (c) 3-hydroxybutanoic acid and 2-hydroxybentanoic acid
  - (d) 3-hydroxybutanoic acid and 4-hydroxypentanoic acid
- 24. A and B in the following reaction

- (d)  $A = H_3C CH_3$ ;  $B = H_3C CH_3$ 25. The metal d-orbital that are directly facing the ligands in  $K_3[Cc(CN)_a]$  are
- (a)  $d_{xy}$  and  $d_{x^2-y^2}$  (b)  $d_{xy}$   $d_{xz}$  and  $d_{yz}$ (c)  $d_{x^2-y^2}$  and  $d_{z^2}$  (d)  $d_{xy}$   $d_{yy}$  and  $d_{z^2}$ 26. The pair of metal ions that can give a spin-only
- magnetic inoment of 3.9 BM. for the complex  $[M(H_2O)_c, C_c^2]$  is (a)  $C_c^2$  and  $Mn^2$  (b)  $V^{2s}$  and  $C_c^{2s}$  (c)  $V^{2s}$  and  $F_c^{2s}$  (d)  $C_c^{3s}$  and  $F_c^{2s}$
- 27. 50 mL of 0.5 M exalic acid is needed to neutralise
  28 mL of sodium hydroxide solution. The amount
  of NaOH in 50 mL of the given sodium hydroxide
  - (a) 10 g (b) 8 g (c) 4 g (d) 20 g 28. The molecule that has minimum/no role in the
    - fermation of photochemical smog, is

      (a) CH<sub>2</sub>= C (b) N<sub>2</sub>
      (c) O<sub>3</sub> (d) NO
  - 29. In the following reaction
    Aldehyde + Alcohol

    Aldehyde Alcohol
    - HCIO r-BuOH
      CH<sub>3</sub>CHO MeOH
      The best combination is
    - The best combination is
      (a) HCHO and t-BuOH
      (b) CH-CHO and t-BuOH
  - (c) CH<sub>3</sub>CHO and MeOH (d) HCHO and MeOH
  - Freezing point of a 4% aqueous solution of X is equal to freezing point of 12% aqueous solution of Y. If molecular weight of X is A, then molecular weight of Y is
    - (a) 2A (b) 3A (c) A (d) 4A
- (d)
   (b): Given, λ = 4000 Å
  - $v = 6 \times 10^{5} \text{ m s}^{-1}$  $hu = w_0 + \frac{1}{2} mv^2$  [ $w_0 = \text{work function}$ ]

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## $w_0 = hv - \frac{1}{2} mv^2$

 $= (4.9695 - 1.62)10^{-19} = 3.3495 \times 10^{-19} \text{ J}$ 

 $w_0 = \frac{3.3495 \times 10^{-19}}{1.6 \times 10^{-19}}$ -eV = 2.0934 = 2.1 eV

3. (b): K, Rb and Cs form super exides on reaction with excess air

 $Rb + O, \longrightarrow RbO,$ 2RbO, + 2H,O -> 2RbOH + H,O, + O,1

4. (c) :  $A_{(g)} \rightleftharpoons B_{(g)} + C_{(g)}$  $D_{tol} \Longrightarrow C_{tol} + E_{tol}$ 

P1+P2 P2  $K_{P_1} = x = P_1(P_1 + P_2)$  atm<sup>2</sup>  $K_{P_1} = y = P_2(P_1 + P_2)$  atm<sup>2</sup>

 $x + y = (P_1 + P_2)^2 \implies P_1 + P_2 = \sqrt{x + y}$  $P_{\text{Total}} = P_B + P_C + P_E = 2(P_1 + P_2) = 2\sqrt{x + y}$  atm

(b): HCHO + Ph - CH - CH<sub>2</sub> - MgX

→ Ph - CH - CH-CH-OH 6. (a): Clean water has a BOD value less than 5 ppm

whereas highly polluted water has BOB value of 17 ppm or more. 7. (b): Electronic configuration of element Og (118) is [Rn] 5f146d107s27p6. Thus, next electron will go

in 8s-orbital. Thus, element with Z = 120 will be an alkaline earth metal

8. (a): Adsorption = Therefore, H2 gas shows least adsorption on a definite amount of charcoal.

10. (c):A + 2B ⇒ 2C + D 150 At eq. a - x 1.5a - 2x

As given, at equilibrium,  $a - x = 1.5a - 2x \Rightarrow x = 0.5a$  $ICI = 2x = 0.5a \times 2 = a$ 

[D] = x = 0 Se

 $|B| = 1.5a - 2 \times 0.5a = 0.5a$ |A| = a - x = a - 0.5a = 0.5a

11. (b): More the intermolecular interaction more will

be the melting point. Among the given, naphthalene has least intermolecular interaction and hence it has lowest melting point.

12. (a) :  $\Delta H' = -\kappa FE' + \kappa FT$ 

 $= -2 \times 56000 \times 2 + 2 \times 96000 \times 300 (-5 \times 10^{-4})$ = -384000 - 28800 = -412.8 kl mol<sup>-1</sup>

13 (b): 10"3 M means 10"3 moles of CaSO4 present

Mass of  $CaSO_4 = 10^{-5} \text{ mol} \times 136 \text{ g mol}^{-1} \text{ or } 136 \text{ mg}$ le., :: 136 mg of CaSO4 present in 1 kg of water 106 g of water will have 136000 mg CaSO.

136 e CaSO, a 100 e CaCO,  $136000 \text{ mg CaSO}_4 = \frac{100}{136} \times \frac{136000}{1000} = 100 \text{ g CaCO}_3$ 

Thus, hardness of water = 100 ppm 14. (b): According to unit of rate constant it is a zero order reaction, then half life of zero order reaction

 $t_{M2} = \frac{C_0}{2k} = \frac{5}{2 \times 0.05} = 50$  years 15. (c) : More nucleophilic is the nitrogen in the compound, more reactive it will be with alkyl halide.

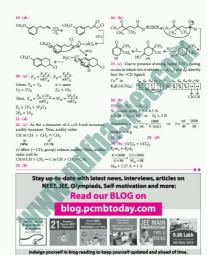
Hence, the correct order is B < A < C < D. 16. (a):1, + 10HNO, -> 2HIO, + 10NO, + 4H,O Conc

Let oxidation state of I be x +1 + x + 3(-2) = 0

18. (c): Compounds that contain at least one carbonmetal bond are called organometallic compounds.



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## Studying continuously for long hours out taking any bre

One of the most common mistakes that student commit is studying continuously for 5-6 hours. With continuous study, the mind shuts down after a while and eventually. nothing feeds in.

So, plan your study time for a total of 8-12 hours daily but with power gaps in between. Your study should include small breaks in between so that you can refresh your mind and start learning with new energy. This way you can also beat procrastination. Brisk exercise or entertaining yourself by watching TV is not a set back but rather helps you relax your mind during the breaks.

#### Not reading the entire question paper before the evam starts Generally, students make the mistakes of not reading the entire question paper before

the exam starts, and thereby not setting the priority on how to write the paper. They don't greanise their thoughts before writing the answers. Even board has allotted an extra 15 minutes time to read the musclime names of El churlents do not use this time legibly and usually write unplanned answers. Therefore, students should utilize these 15 minutes so that they can organise their thoughts and manage their time during the

No proper time manage ment while writing the

Another most important task student should consider while writing the answers is proper time management, but most of the students start writing the paper without taking care of time. When the time gets over, they are left with no other option than leaving some questions unattempted, due to which they lose their precious marks. The best way to avoid this mistake is to solve more and more sample. papers and previous years' papers which will give you ample idea bout how to manage time during the exam-

## Not enough writing practice

Often students lap behind in board simply because they do not have enough writing practice. The answers for board questions can be really lengthy, and if you get stuck in a question or more, you might face time crunch. You may leave questions unafter pled which you knewbetter, and it's a real pain which you will always regret. So, writing practice is a MUST. For this, students need to solve as many sample papers as they can, CRSE has released their sample papers. Don't miss to practice all these sample papers. Also refer to MTG Score more 21 sample papers for more and better practice. The sample papers given in it are designed as per the latest changes introduced by CBSE. The Self Evaluation sheet is also provided after each Sample Question Paper (SQF) which will help you to assess your performance

student should avoid in CRSF board example of the country of the c CBSE 12th board exam plays an important role in deciding the career prospects of every student- It is therefore absolutely imperative that students must study for CBSE Board exams with night approach and technique to perform well. Along with the night plan, it is essential to know where you might comm t mistakes or what are your patterns of misir terpreting

## Forget to write proper steps, formulae and diagram whenever

Sometimes student forget to write the formulas while solving numerical problems. These formulas and diagrams are mandatory in the context of subjective answers and helps you score more in your answers. So, don't forget to write proper steps and formulas and make diagrams where they are

## nueded Not checking and revising the answers efore submission of the answer sheet

Yet another most common mistake is handing over the sheet to examiner without checking and revising the answers. While writing the exam some of the students think faster than their writing speed, so they skip to write some required terms in the answer. Due to these silly mistakes, the answer does not make sense at times. To make it worst, sometimes, such faster thinking students skip to write NOT in the sentence where needed, giving a completely occopite meaning and thereby making blunder unintentionally. This is an absolutely disaster for those who intends to score high.

of checking whether written the relevant information like roll no, etc. before submitting the answer sheet

Also, after completing the paper, students just handover their answer script to the examiner without even checking if they have written their rolling, or other relevant and asked information correctly or not. So, it is very important for a student to spare some time towards the end to check the answer script properly before submitting it to the examiner.

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Hell of friends!! Yes Yes Yes!! Exam season has finally arrived and we already done with first phase of IEE Main examination Hope you all have done well. The pattern of the questions were as par what we have discussed in conrept border earlier. This issue is again devoted to a critical thinking part in coordination chemistry and this article is all about identifying colour in coordination compounds. A single question can vary your rank and hence every single article can change your destiny from nadir to zenith. So, enjoy and combat the battle. All the very best. \*Anunava Sarkar

#### Shortcut-1 nce can be either clockwise

or counter clockwise

P = Purple, V - Violet, I = Indigo, B = Blue, B-G = Blue-G G = Green, Y-G = Yellow-Green, Y = Yel R = Red

Shortcut-2



of shortcut-1 +(AB) [M(H2O)4(AB)]3+ +(AB)

 $[M(H_2O)_2(AB)_2$  $[M(AB)_3]^{3+}$ Colour - ? z

What is the col

(a) P (b) Y (d) Y-G oln.: (c) As X is green, therefore, in the colour wheel

start from Green and go to Violet. You get blue in between. ... Correct option is (c).

Application of shortcut-3 Correct increasing order for the scavelengths of

absorption in the visible region for the complexes of (a) [Co(H-O), 13+, [Co(en), 13+, [Co(NH, ), 13+

(b)  $[Co(H_2O)_6]^{3+}$ ,  $[Co(NH_3)_6]^{3+}$ ,  $[Co(\epsilon n)_3]^{3+}$ (c)  $[Co(NH_3)_6]^{3+}$ ,  $[Co(\epsilon n)_3]^{3+}$ ,  $[Co(H_2O)_6]^{3+}$ (d) [Co(en)-]3\*, [Co(NH-)-]3\*, [Co(H-O)-]3\*

**INEET 2017** Soln.: (d) \(\lambda \) \(\simes \) Weak field ligand

: H<sub>2</sub>O < NH<sub>3</sub> < en (strength) : Wavelength : H-O > NH > en There are many factors responsible for colours in

coordination compounds. However, as per crystal field theory colour in coordination complexes arise due to two aspects:

1. d-d transition - Popularly known as d-d spectra or ligand field spectra.

2. Charge transfer transitions - Popularly known as charge transfer spectra.

In case of d-d transitions, what we first see is whether the metal is having any unpaired electron or not. This unpaired electron takes part in transition. We have also seen the e, and to splitting of 'd' orbitals. However, celour due to d-d transition is not so simple as orgel

\*Institute of Chemistry (IOC)- Asansol, Durgapur, Dhanbad, Burdwan, Kolkata, Jamshedpur, Bokavo, Patna CHEMISTRY TODAY | FEBRUARY 11

On the other hand, there are certain d and d to species likes K2CrO4, KMnO4, HgI2 which are intensely coloured. But definitely the colours of these species are not due to d-d transition but due to charge transfer

absorption. We also find some other examples like FeCls. FeBry, Fely etc. which are exceptions for the concept of d-d transition

Frankly speaking, charge transfer is a redox process. If we consider Fe<sup>3+</sup> ion (d<sup>3</sup> metal ion) as an oxidising ion and X" (like Cl , Br etc.) as reducing ion then an electron transfer takes place from X to the empty valence orbital of the exidising ion. Now, the major question is, what conditions will favour charge transfer absorption? Answer can be attributed to both oxidising as well as reducing ion differently.

- For metal ion : Having high ignisation energy.
- Empty orbitals with lower energies
- These two conditions will favour charge transfer from ligand to metal.
- For ligand: Lower electron affinity
  - Filled orbitals of relatively higher energy. Remember that absorption of light is more probable in case of charge transfer spectra than that of d-d tra

Hence, charge transfer absorption always produces intense colour. Following charge transfer transitions are mostly to be

considered Ligand to Metal Charge Transfer (LMCT Mostly octahedral and tetrahedral complexes undergo this type of charge transfer

σ bonding Empty T2e Chicp orbitals or E, orbitals filled # orbitals Ligand

to and e notations are slightly different in meaning However, in this context and scope, you can take them same.

Charge номо -Energy difference is quite lev

Here, light is absorbed from the visible region or near UV region. CHEMISTRY TODAY | RESIDENTE

Examples:

- 1. MnO<sub>4</sub> (Purple): Simple ligand-metal charge transfer
- 2. I complexes: I is an easily exidisable species due to its large size. So, in case of I' complexes, even if the metal ions are not good oxidants, LMCT takes place.
- Fels (intense black), Pals (vellow), Hgls (red) 3. Examples for the transitions where charge transf takes place from π orbitals of ligands to metal orbitals include CdS (yellow), HgS (red), PbG (yellow), etc.

In these transitions, ns, np or nd orbitals of metal can Metal to Ligand Charge Transfer (MLCT)

Two conditions are there (a) Ligands have vacant orbitals with relatively lower

(b) Metals have filled orbitals with relatively higher energy. A

MLCT is basically observed for octahedral complexes having CO, py, 69y, o-phen etc. as ligands and SCN too in some cases e.g., [Fe(SCN)6]3-, [Fe(o-phen)1]2+,

Metal to Metal Charge Transfer (MMCT) It is very easy to understand as here the whole idea

inculates around metal. MMCT occurs in those cases where a metal ion exists in two different oxidation states. eg., Prussian blue, Fed [Fell(CN)], etc.

CBSE students excelling in international sports can take exams later

In a positive development for school students who excel in sports, the Central Board of Secondary Education has made it possible for them to annear for their Class X and XII Roard Fyams at a later date if international sports events clash with the timetable.

The board has created a special provision for such students to ensure that their exams and sporting events do not clash and that they do not have to miss out on either of them.

The concrete policy was created after the board received multiple request from students over the past few years. In March-April 2018, the board had given concessions to nine students studying in CBSE schools from across the country as their events coincided with the exam dates

As per a circular issued by the board on 26th December 2018, students who wish to avail the concession have to make a request to the board in writing through their schools along with the recommendation of the Sports Authority of India informing of their participation in a particular international event. The board will conduct exams for students whose requests have been accepted at a later stage, on a date mutually convenient to the student and the board. The examination, however, will be conducted before the results of the board exams are scheduled to be declared.

## 1. (b): COOH CH,OH

3. (a): 
$$E_{cell} = \frac{0.059}{2} log \frac{[H^+]^2_{cathode} \times [p_{H_2}]_{mode}}{[H^+]^2_{mode} \times [p_{N_2}]_{model}}$$

 $[OH^-] = \sqrt{CK_b} = \sqrt{0.1 \times 10^{-5}} = 10^{-3}M$ 

$$[H^{+}]_{\text{mode}} = \frac{10^{-14}}{10^{-3}} = 10^{-11} \text{ M}$$

$$[H^{+}]_{mode} = \frac{10^{-11}}{10^{-3}} = 10^{-11} \text{ M}$$
  
 $[H^{+}]_{cabode} = \sqrt{CK_{g}} = \sqrt{0.1 \times 10^{-7}} = 1$ 

$$\therefore \ E_{\rm cell} = \frac{0.059}{2} \log \frac{\left(10^{-4}\right)^2 \times 0.1}{\left(10^{-11}\right)^2 \times 1} = 0.38 \ \rm V$$

4. (b): Total mole of H<sub>2</sub> = 
$$\frac{1 \times 1}{300 \times 0.083} = 0.040$$

.. Total mole of H atoms = 0.040 
$$\times$$
 2 = 0.08  
Energy needed to excite 1 mole electrons in H atom  
from  $n = 1$  to  $n = 3$  is:  

$$E = \frac{h_L}{h} = h_C R_B \left[ \frac{1}{1^2} - \frac{1}{3^2} \right] \times N_A$$

$$E = 6.625 \times 10^{-34} \times 3.0 \times 10^6 \times J.1 \times 10^6 \times 10^{-34}$$

7. (a) 
$$\stackrel{\circ}{\underset{\text{(a)}}{\overset{\circ}{\underset{\text{(b)}}{\overset{\circ}{\underset{\text{(b)}}{\overset{\circ}{\underset{\text{(c)}}{\overset{(c)}}{\overset{(c)}{\overset{(c)}}{\overset{(c)}{\underset{\text{(c)}}{\overset{(c)}}{\overset{(c)}{\underset{\text{(c)}}{\overset{(c)}{\overset{(c)}}{\overset{(c)}}{\overset{(c)}{\overset{(c)}}{\overset{(c$$

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8. (b)
                            B^{n+} \longrightarrow B^{(n+4)}
9. (2):
    Initial millimole
    At time t
```

 $2e^- + B^{n+} \longrightarrow B^{(n-2)+}$  $S_{n}^{-} + g(n+4)+ \longrightarrow g(n-1)+$ 

Let normality of reducing agent be N. Thus at t = 0,  $a \times 2 = N \times 25$ 

At t = 10,  $(a - x).2 + x.5 = 32 \times N$  $3x = 7 N \Rightarrow x = 7/3N$ 

25/2N

2.303

= 2.07 × 10<sup>-2</sup> min<sup>-1</sup> Comparing it with  $x \times 10^{-2}$ , we get x = 2

10. (3): (NH<sub>d</sub>)<sub>2</sub>SO<sub>d</sub>, (NH<sub>d</sub>)<sub>2</sub>CO<sub>3</sub> and NH<sub>d</sub>Cl give NH<sub>3</sub> on heating as shown:

(i)  $2(NH_4)_2SO_4 \xrightarrow{\Delta} (NH_4)_2S_2O_7 + 2NH_3 + H_2O$ 

reresulphate 3(NH<sub>4</sub>),S<sub>7</sub>O<sub>7</sub> - >2NH<sub>1</sub> +6SO<sub>2</sub> + 2N<sub>2</sub> + 9H<sub>3</sub>O

(ii) (NH<sub>4</sub>)-CO<sub>2</sub> → NH<sub>4</sub>HCO<sub>2</sub> + NH<sub>3</sub> (iii) NH<sub>2</sub>Cl → NH<sub>2</sub>+ HCl NHaNO, and (NHa)-Cr-O, on beating gives N-O

and N- respectively as shown; (iv) NH,NO, - N,O + 2H,O

(v) (NH<sub>4</sub>)-Cr<sub>2</sub>O<sub>2</sub> → N<sub>3</sub> + Cr<sub>2</sub>O<sub>4</sub> + 4H<sub>2</sub>O

Scientist of the Month



Syante August Ambe (19 February 1859 - 2 October

Early Life and Education

Arrhenius was been on 12 February 1839 of STR near Uppsale, Sweden. At the age of three Arrhenius cought birnedf to read without the

encouragement of his paperts, and by witching his father's addition of numbers in his account books, became an arithmetical product. At are cight, he entered the local cathedral school, starting in the fifth grade, daraguashing himself in physics and mathematics, and gradiency as the younges, and most able student in 1876. He started study in the Physical Institute of the Swedish Academy of Sciences Abobs under the physicist link fidland in 1881.

- His work focused on the conductivities of electrolytes. In 1884,
- based on this work, he submitted a 150-page dissertation on electrolytic conductivity to Uppsala for the doctorate He has discussed a very important idea in his dissertation which explains the fact that solid crystalline salts dissociate into paired
- charged particles when dissolved. Arrhenius' explanation was that in forming a solution, the salt dissociates into charged particles,

ACA Michael Faraday had given the name ions many years

- Amberius proposed that, even in the absence of an electric provist, aggreeus solutions of salts contained ions. He thus respond that chemical reactions in solution were reactions
- In an extension of his ionic theory Arrhenius proposed definitions for acids and bases, in 1884. He believed that acids were substances that produce hydrogen ions in solution and bases were substances that produce bydroxide ions in solution. In 1889. Arrhenius explained the fact that most reactions requir
- added best energy to proceed by formulating the concept of activation energy, an energy barrier that must be overcome before About 1900, Arrhenius became involved in setting up the Nobel Institutes and the Nobel Prizes. He was elected a member of the
  - Reval Swedish Academy of Sciences in 1901. He was the first to use basic principles of physical chemistry to calculate estimates of the extent to which increase in atmospheric carbon distride increase the Earth's surface temperature, leading David Keeling to conclude, and demonstrate in the 1960s, that human-caused carbon dioxide emissions are large enough to cause

#### global warming Awards and Honours

- Davy Medal (1902)
- Nobel Prize for Chemistry (1903) Willard Gibbs Award (1911)
- Funder Lectureship Prior (1914) Franklin Medal (1920)



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## YOU AS WE ANSWE

Do you have a question that you just can't get answered? Use the vast expertise of our MTG team to get to the bottom of the question. From the serious to the silly, the controversial to the trivial, the team will tackle the questions, easy and tough. The best questions and their solutions will be printed in this column each month

## Why do some batteries have to charge for 8 hours for the first time? Is it true for Li-ion battery also?

Ans. There is always a gap between manufacturing and purchasine period. In this period the battery of electronic device gets discharged itself due to this its voltage gradually reduces. When depleted below the low-voltage threshold of the protection circuit, it will be disabled and cannot be further discharged until recharged and when you charge it fully, battery comes to its ontimum state and work well. Thus, Ni-Cd. lead-acid batteries are often asked to charge for 8 hours for the first time. But now a days, batteries are often Lithium-ion or Lithium polymer and these Li-ion batteries have a protection circuit which prevents the battery from dropping too love in voltage. Thus, it is not required to fully charge Li-ion battery for the first time. 2. How to decide the stability of alkenes

#### (Supartirtha Sengupta)

Ans. The stability of alkene can be determined by measuring the amount of energy associated with the hydrogenation of molecule. Hydrogenation specifically affects the double bond. Since the double bond is breaking in this reaction, the energy released in hydrogenation is proportional to the energy of the double bond. Thus, smaller the numerical value of the heat of hydrogenation of an alkene, the more stable the double bond happens to be. The heat of hydrogenation therefore describes not the overall stability of the molecules, but rather the stability of the reactive part of the molecule (the carbon-carbon double bond). The heat of hydrogenation is usually around -30 kcal/mel for alkenes. The following illustrates stability of alkenes with various substituents

Least substituted

Least stable

The electron density of an sp -hybridized atom is held closer to the nucleus than that of an so hybridised atom. Because alkyl groups are much polarizable than hydrogen atoms, they more readily satisfy the electron demand of the st-bybridized carbons. Therefore, the replacement of hydrogen atoms on a double bond by alkyl groups stabilizes the alkene and accounts for the observed order of sta

Why the Electron Affinity of Be is similar to He? Ans. The energy liberated when a neutral gaseous atom in its ground state accepts an electron to form the gaseous negative ion is called electron affinity. Electron affinity of most elements are positive, but when the atom has a fully filled configuration, addition of an extra electron may be unfavourable e.g., helium (152). In the same way an electron would have to be added to the 2p orbital of beryllium which already have stable fully filled shell (2s2). Thus, both Be (2s2) and He (1s2) shows similar negative electron affinity value.

How to transform nitrobenzene into paracetamol?

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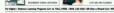














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